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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

The cultivation of tobacco is fully dealt with in this issue. The matter published is also available to tobacco growers in pamphlet form. The present position of "Bunchy Top" investigations is fully described in a comprehensive report by Dr. Darnell-Smith. The Northern Instructor in Agriculture, Mr. N. A. R. Pollock, supplies some useful notes on the cultivation of winter greenfeeds in his territory. The work of the Stock Experiment Stations at Yeerongpilly and Townsville for the past year is also reviewed. Mr. Shelton's subject this month is the Poland-China breed of pigs. Included among other useful features is an informative note on a new cotton pest by Mr. Simmonds, B.Sc., of the entomological staff. Pressure on space in this month's Journal has compelled the holding over for the next issue of much other useful matter, including the regular sugar field reports, a valuable report on fruit fly investigations in the Stanthorpe district, tables and appendices supplementary to Mr. Eklund's notes on irrigation in Queensland, and abstracts and reviews.

Sheep on the Northern Tablelands.

In an interesting report to the Minister (Hon. W. N. Gillies) Mr. W. G. Brown, Instructor in Sheep and Wool, discusses the practicability of sheep-raising on the Atherton and Evelyn Tablelands. Mr. Brown, after a close observation of local conditions, lectured to farmers in the several Tableland centres on the possibilities of sheep-farming in localities in which hitherto comparatively little attention has been given to the industry. Sheep-raising on the northern highlands is, of course, not a new idea. Several settlers have been successfully running flocks there for periods varying from seven to thirteen years. Tableland farmers generally have evinced a keen interest in the prospect of adding yet another profitable side line to their enterprise. The dingo pest is the only really serious difficulty in the way, its presence making night-yarding a necessity. Existing flocks on the Tablelands are strong and healthy, but their numbers are insufficient to supply the local mutton demand. Sheep for the local meat market have now to be brought all the way from the Hughenden pastures, and the long journey by rail and steamer is against their being delivered in prime condition. Local sheep slaughtered by Mr. Brown showed no signs of worms or disease and the mutton was excellent. Not much attention has, however, been given to breeding a high type, but local flocks might be improved

in a comparatively short time by introducing good blood from Southern studs. If most farmers kept a small flock, fifty animals, say, the Tableland settlements could easily supply the whole of the Northern mutton trade. The land there is of the best, with a rainfall up to 70 inches per annum, and Mr. Brown declares that most of the country he inspected on his recent tour of duty has a carrying capacity of five ewes to the acre. The Northern Tablelands generally are, he considers, good districts for farmers' sheep. In Queensland there is none better.

The Romance of Wool.

The extraordinary world wide demand for wool, a demand reflected in the "record" values at the last Brisbane wool sales, naturally increases interest in sheep as a profitable side line on small holdings. Scarcely any phase of Australian development can compare with the success that has attended sheep-breeding. Wool has largely made Australia what she is to-day and wool still ranks as our greatest wealth-winner. The story of Australian pastoral development is full of romance. Early in our history Australian wool won world-wide fame, to-day it passes through the looms of every nation, and our sale rooms echo a babel of voices in fiercest competition from every country. The story is no mere record of success imposed upon success, or of an easy journey along a straight unrutted road; it is a story of courage, triumph over difficulties, and the exercise of all that is great in national character.

Sheep on Small Holdings.

The present wool position naturally suggests closer attention to the possibilities of sheep-raising on the farm. All countries have been forced to face the problem of how to profitably use high-priced land after the hunting and pastoral stages have been passed. Queensland is now confronted with this problem in respect to country within, say, 150 miles of the seaboard. In Britain the problem was settled generations ago. Every A.I.F. man interested in animal husbandry who had an opportunity of seeing rural England was amazed at the number of stock carried on her pastures. In Scotland and Ireland similar conditions obtained. Every farm seemed to have its flock of sheep. In the aggregate there are now something like 24,000,000 sheep in small farmers' flocks in the British Islands. Compared with this number our last available statistics (1923) show that in the whole of Queensland there are depastured no more than 18,000,000 sheep. In Britain 500 is a large flock. Mixed farming is the answer to the question as to the use of high-priced land to the best advantage. Instead of the farmer merely growing produce to cart to market—produce which in bountiful seasons gives only comparatively small returns and in dry seasons is only scantily grown—he will turn his produce into manufactured commodities—butter, cheese, bacon, meat, and wool. These commodities are in world-wide demand. There is a vast accumulated fund of theoretical and practical information upon which to draw, for in all the lands of the older countries generations of "mixed" farmers have left records of their work. Sheep-raising has been practised by them along every conceivable line of breeding and feeding, and this section of animal husbandry has nearly reached perfection. Some of that knowledge has been presented in the Journal from time to time, and so much of it as affects Queensland questions is now available in bulletin form for distribution to farmers who contemplate the establishment of another profitable side line on their holdings.

Handling Small Clips.

The Department of Agriculture and Stock receives and classes farmers' clips from flocks of 1,500 sheep and under. No lot is too small for consideration. One bag or even one fleece is classed according to its grade, and every lot is handled by skilled wool sorters. On delivery at the departmental wool room consignments are weighed and valued. If required, an advance of 60 per cent. on the initial appraisement is sent to the farmer by return mail, the balance being adjusted on market realisation. The advantages to the farmer under this scheme are his obtaining of the best possible service at the minimum rate of commission, 1¼ per cent.; the extremely low classing rate of 10s. per bale; and the reduction of all other charges to a minimum. Without a scheme of this character farmers' small lots would ordinarily have to be offered in unattractive parcels, and low values would consequently rule. The department aims to encourage the keeping of some sheep on every farm on which conditions are suitable, and to obtain the best values for small clips by placing them before the buyer in attractive and even lines. At the last sales in Brisbane farmers' lots marketed under the scheme brought up to 31d. for merino, 31d. for crossbred, and 23½d. for merino pieces, and these results would not have been possible without efficient preparation of the product and its effective presentation on the market.

"BUNCHY TOP" DISEASE IN BANANAS.

BIOLOGIST'S REPORT.

Dr. G. P. Darnell-Smith, Biologist, New South Wales Department of Agriculture, in the following report, summarises recent field observations and states the present position in regard to laboratory work.

Symptoms of the Disease.

Plants affected with bunchy top manifest the disease somewhat suddenly. The first, and, so far as I know, infallible sign of bunchy top is the development of a green streak or streaks upon the under side of the midrib of one of the younger leaves.

Normally the midrib of such a leaf has a particularly even pale-green colour. It is covered with white wax, especially the basal portion, through which the colour may be seen. In a plant about to become bunchy a streak an inch or less in length of a darker green makes its appearance in the midrib. In some cases this is followed by other short green streaks, or by streaks extending nearly the whole length of the midrib. In later stages older leaves will show a number of parallel green streaks on their under side at the point of their attachment to the pseudo-stem. (It is stated by some growers that the irregular distribution of the chlorophyll adjacent to the parallel vein of the leaf, and which has the appearance of green streaks, is a sign of bunchy top; but while such a streaky appearance is often to be seen when the leaf of a bunchy top plant is held up to the light, I have seen a similar streaky appearance in the leaves of plants which have not had a check of any kind, and it is frequently to be noted in the first leaves put forth by plants after their somewhat dormant period during the winter months.) After the appearance of the green streaks abovementioned in the midrib the plant ceases to develop normally. The young leaves do not expand and attain their full size, being a little shorter than normal. They do not spread normally, and assume a position more or less at right angles to the incident light, but point upwards and, as successive leaves develop, the apex of the pseudo-stem appears to become constricted and the leaves to become bunched together. The laminæ of the leaves now become exceedingly brittle, as also does the midrib, and often many of the leaves are markedly ridged. The central leaf now develops abnormally, the particular abnormality depending on the age of the plant. In a healthy plant, say, six months or more old, the central leaf is tightly rolled and has upon its apex a small cap, which remains upon the tightly-rolled leaf until it has attained almost its full length. The cap then withers and the leaf unfolds and expands rapidly. In a bunchy top plant of the same age the cap falls away prematurely, the leaf does not expand rapidly, and in the funnel formed by the partially unfolded leaf water collects. In this stagnant water bacterical action soon gets up putrefaction and the centre of the plant may become a putrid mass. In other cases the constriction and cessation of growth at the apex of the stem prevent the young leaves from developing, although there is pressure from below, and on splitting open such a stem, the tissues of the young leaves will be found to be compressed and distorted. On splitting open the pseudo-stem, in addition to the distortion here described, some scattered brown areas about a quarter of an inch in diameter are to be found in the leaf sheaths. They are somewhat gummy in appearance. Smears from these areas have not revealed bacteria. In young plants the central leaf is tightly rolled and depressed to the upper surface of the midrib of the last leaf to unfold. In a healthy plant it remains in this position for a considerable period, and then unfolds from the apex downwards. In a diseased plant it quickly assumes an upright position and starts to unfurl from the centre. If a plant eighteen months old or more is about to throw a bunch of fruit, this is carried up on the apex of the stem in the centre of the pseudo-stem. In a bunchy top plant this bunch of fruit may fail to get past the constriction at the apex of the pseudo-stem; it may get half out or it may get wholly out. In any case the fruit is short, brittle, and sweet. The bracts subtending the male flowers are uniformly dark-red in colour in a normal plant; in a bunchy top plant they are generally tipped with green and curl backwards to a greater extent than usual.

Healthy banana tissue, both in the corm and pseudo-stem, is almost wholly white when first cut open. If cut with a steel knife a purplish colour will soon appear over the surface. The cut surface of a bunchy top corm develops this colour much more slowly.

A corm in the incipient stages of the disease shows when cut open small ducts of a pale yellow colour, irregularly distributed. These ducts run in every conceivable direction, following the course of the vascular bundles, so that sections may be transverse, longitudinal, or oblique. I am not certain of the exact nature of these ducts; usually there are two, one on each side of a vascular bundle. They may be traced upwards through the corm and out into the base of the pseudo-stem, and they

extend upwards into the leaves. The number of these discoloured ducts increases with the progress of the disease, so also does the intensity of their colour through yellow, red, brown, to black. By the time the colour has become red the contents have become solid, and they frequently have a moniliform appearance. It is to this solidification that the brittleness of the tissue of a bunchy top plant is probably due in part.

The roots originate at the stele, pass through the fleshy cortex and so into the soil. The main roots are fleshy and of uniform diameter throughout. From these, small thread-like roots arise laterally and branch profusely. On the thread-like roots and back of the main root tips are born the root hairs. The roots may extend outwards six feet or more. Upon healthy corms many roots are found that are dead and decayed, so that the occurrence of dead roots would appear to have little significance. In a bunchy top plant in an advanced stage of the disease practically all the roots are dead to within three inches or so of the corm, and in many cases the decayed root tissue traverses the cortex as far as the stele. The xylem vessels are often brown, brown patches are found in the cortex of the roots, and a variety of organisms, including *Fusaria*, are found just inside the decayed ends.

Two species of eelworms have been found in the roots of bananas on the Tweed. The banana bettle borer "*Cosmopolites sordidus*" is widely distributed, and a beetle, which the Entomologist has identified as *Gonocephalum Mastersi*, was found gnawing the corms. Except as possibly exposing the root or the corms to infection, these do not appear to have any relation to the cause of bunchy top. An examination of numbers of preparations taken under aseptic conditions by means of forceps and scalpel, or by boring solid corms with a cork borer and taking the centre of the corms from plants in an advanced stage of bunchy top, has convinced me that these plants have to a large extent lost their immunity and that secondary invasions have taken place. The cause of bunchy top must be sought in healthy suckers planted in a bunchy top infected area and examined immediately the first signs of the disease present themselves. These suckers must be obtained in the first place from a district where the disease has never been known to occur. Appropriate infection experiments must then be carried out under control conditions, a matter to which I will refer later. Suffice it to say for the present that until this month these control conditions have not been available.

I have made a comparison of healthy and diseased roots. In a healthy root the primary meristem occupies only a very small portion behind the root cap and is very tender. The roots have little power of threading their way around obstacles; the root tip dies when it meets a boulder and a lateral is formed. Healthy roots grow rapidly, their tips and the young part of the root are creamy-white in colour, numerous laterals are produced which are also creamy-white in colour, they appear to function for a short time only, when they die and become dark-brown or bluish-black. The surface of the older parts of the main root may be brown or purplish in colour. The roots of a bunchy top plant often have greyish-coloured tips and grey-coloured laterals; these latter are often of a purple hue and many patches of epidermal cells, bright blue in colour, are frequently to be found upon them. The root hairs are frequently open at their ends and full of organisms having the appearance of minute micrococci. Zooglacal formations of a brilliant blue colour are also to be found on the surface of the roots, and the epidermal cells in contact with them become blue.

Observations which Suggest that the Cause of Bunchy Top is to be Found in the Roots or in the Corm.

A healthy corm and a diseased corm were kept in slowly running water for a fortnight. The development of white roots upon the healthy corm was very rapid. The development of roots upon the unhealthy corm was slow; they assumed a grey colour with blue patches in places. On planting this corm in the soil it developed three perfectly healthy leaves and then reverted to the bunchy top condition.

A heap of discarded healthy suckers from Queensland was observed in the Tweed River district. They had been thrown in the shade and had remained there some time. Some of the corms had developed surface roots, white and healthy looking, and they had also thrown up young and healthy looking stems and leaves. At my request the grower planted them. In three months he reported that they had developed bunchy top.

The experience of nearly all planters is that when an area of ground is planted to bananas some of these turn bunchy. If these are removed and fresh corms planted in the same or adjacent holes these also become bunchy.

While bunchy top may make its appearance upon plants widely separated in a plantation, usually the plants round about or adjacent to the ones first showing signs of disease are the next to follow.

Bunchy top corms kept under observation give one the impression that the plant is trying to form roots and is unable to do so. Those at the base of the corm usually decay first, then those immediately above. When these decay fresh roots are formed nearer the stem base; these in turn succumb, and are followed by others smaller and more insignificant arising almost from the stem base itself.

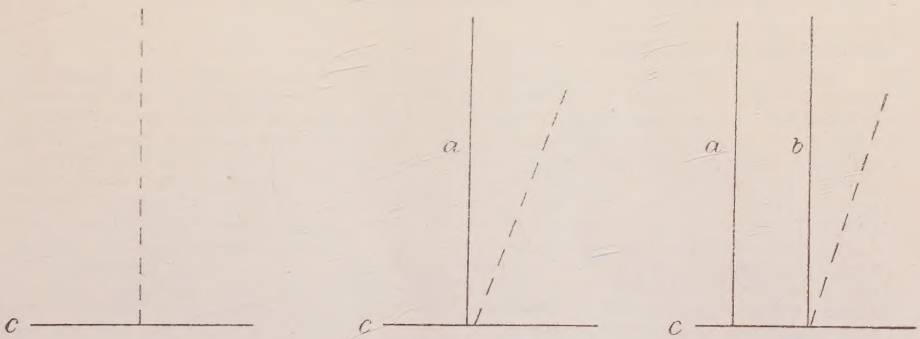
A diseased plant was kept for a year in a pot surrounded by six healthy plants; none of these latter became bunchy.

Two healthy (?) plants have been under observation in pots for two years. Quite recently they have turned bunchy.

These observations suggest: (1) Fungus or bacterial infection of the root or corm; (2) that the infecting organism may act as a saprophyte or a parasite. They are in accord with the sporadic occurrence of the disease.

These suggestions are supported by the history of the disease in the field. When an area is newly planted, generally only a few of the corms turn bunchy within the first eighteen months. At this period they throw a bunch of fruit, and it is after this "first cut" that a large number usually turn bunchy. At the end of the third or fourth year the disease is generally widespread.

Diagrammatically the position may be represented thus: the dotted lines represent a Bunchy Top plant.



Bunchy 1st Year.
c.—Ground level.

Bunchy 2nd Year.
a.—Old healthy stem of 1st Year.
c.—Ground level.

Bunchy 3rd Year.
a.—Old healthy stem of 1st Year.
b.—Old healthy stem of 2nd Year.
c.—Ground level

The first figure indicates the condition that a few plants attain in the first year, the second figure indicates the condition of a large number of plants in the second year, the third figure indicates the condition of a very large number of plants in the third year.

In pruning bananas the unwanted suckers are removed with a sharp spade or an iron bar. Where the sucker is prized off the parent a large surface is left on the parent or on the sucker through which, if the disease is due to a soil organism, entry could be made. As already indicated, I suspect a soil organism attacking the roots or the corm or both.

Banana Sap.

The sap of a healthy banana is of a pale yellow colour shortly after it is collected. On the corm it soon sets to a dark yellow jelly, which hardens. When examined after being freshly drawn it consists of a transparent serum in which are suspended innumerable globules of a viscid nature which do not coalesce. They give the freshly drawn sap a milky appearance. As the sap coagulates irregular linear solid bodies make their appearance. The sap of a diseased banana is light-red in colour and sets on the corm to a dark brown solid. Under the microscope the appearance is the same as that of healthy sap. In setting, it appears to deposit a greater amount of crystalline substances, but no quantitative estimate has been made. No trypnosones have been observed in the sap. A quantity of sap can easily be obtained by scooping out the centre of a large corm until a saucer-shaped cavity is formed. The saps collects in the cavity. On one occasion some shoots of mallow were placed in this diseased sap, the leaves became blotched in a short space of time, and all the shoots drooped. The phenomenon may have been due to osmosis.

Whilst suspecting a soil organism as the cause of the disease, I picture its action as causing development of a toxin, so that in diseased tissues we shall have toxic sap, and from healthy tissues healthy sap, until with the progress of the disease the accumulation of toxic sap over-balances the healthy sap and we get the development of bunchy top.

A bunchy top plant will frequently throw suckers which remain healthy in appearance for a considerable time. Nevertheless, if removed and planted they invariably turn bunchy top eventually. Locally the disease is said to be hereditary. Internal and external micro-organisms may, of course, be transferred unconsciously.

Digging out Diseased Corms.

It is the usual recommendation and practice when a plant becomes bunchy top to dig it out and let it lie where dug; often it is split open and chopped up in order that it may dry more readily in the sun. To burn it would be a better practice, but sufficient wood is not available. The general consensus of opinion among growers is that this practice stays the onset of the disease sufficiently to give them one bunch of fruit more than where it is not adopted. It may actually aid in spreading the disease, since any soil organisms attached to the roots might be more easily dispersed by the wind. Exposure to the sun, however, may kill them. A number of thoroughly air-dried bunchy top corms were heaped around a healthy plant growing in a pot. After a year the plant so treated remains healthy.

Distribution of the Disease.

At the present time I should regard the whole of the Tweed area as infected. Areas of infection also occur in the Richmond River district. There is little doubt but that the disease was spread considerably by the use of diseased suckers before anything as to its nature was known. I am of opinion that no plant in the Tweed district can be regarded as free from disease, even though it may appear perfectly healthy. I have had two "healthy suckers" from the Tweed district which were grown in pots in Sydney turn bunchy top after two years. These "healthy" plants on the Tweed may have developed a certain amount of resistance. At any rate they do not apparently succumb so rapidly to the disease as many suckers imported from a part of Queensland said to be free from bunchy top. If the casual organism is a soil organism, in addition to its spread upon implements, boots, and the hoofs of horses, there is no difficulty in accounting for its spread by the wind. Most of the plantations are situated at considerable altitudes. In dry weather the soil attains a very dusty condition. Weeds grow rapidly in the district, and are generally kept in check by continual chipping with a hoe. If chipping is carried out during dry, windy weather, clouds of dust are carried for miles.

Possibility of Insects Transmitting or Causing the Disease.

Pressure has been placed upon the Government from time to time to offer a reward for the discovery of a cure for bunchy top. The offering of a reward for such a purpose I have strenuously opposed unless the onus of proof were on the claimant. Otherwise every recommendation, however manifestly absurd, must be tested out by Government officials, with great resultant loss in time and money.

In 1922, Mr. J. Marks, of Terranora, announced that he had discovered the cause and cure of bunchy top. He wanted £5,000 to disclose his secret, and a deputation waited on the Minister to urge the payment of this sum or a large contribution towards it. The deputation, members of a local committee which had viewed a new plantation of Mr. Marks, were so impressed with its freedom from bunchy top that they felt justified in urging the Government to contribute to the payment of the sum claimed by Mr. Marks for the disclosure of his secret.

At the request of the committee to the Minister, I was permitted, in conjunction with Mr. Symington, of the Department of Agriculture, to aid them in drawing up an agreement with Mr. Marks. Briefly, the agreement was thus:—

(*a*) A sum of £5,000 (to which the Government might consider making a contribution) was to be raised by a small levy upon every case of bananas leaving the district.

(*b*) This sum to be paid to Mr. Marks at the end of two years if he were successful with the following test:—

(*c*) One hundred healthy banana-suckers selected from any healthy area by Mr. Marks were to be planted in soil where banana plants had previously succumbed to bunchy top. Mr. Marks, adopting any means he liked, was to keep 95 per cent. of these free from bunchy top for two years.

(*d*) He was to disclose his secret in order that others might test his process.

(*e*) A check plot of 100 healthy plants was to be planted adjacent to the experiment plot. These were to receive no treatment of any kind.

Mr. Marks agreed, and was so sure of his remedy that he guaranteed to keep not 95 per cent. but 100 per cent. of the plants healthy. Three months after the commencement of the experiment one of the plants went bunchy and he lost his £5,000. I immediately wrote to Mr. Marks asking him to continue his trial. This he did. The results are given below. The experiment was carried out at Mr. Sutton's plantation at Terranora. Mr. Marks announced: (1) That bunchy top was due to aphides which attacked the plants; (2) that if no aphides were allowed to attack the plants no bunchy top would develop; (3) that the aphides could be kept in check sufficiently to prevent bunchy top by spraying at intervals with kerosene emulsion.

The previous history of the plot in which the test was carried out was: (1) It bore bananas for five years and then went out with bunchy top; (2) it was replanted with local bulbs, these went out with bunchy top practically within a year, only about 12 per cent. remaining healthy.

Mr. Marks' plot was planted 9th November, 1922. It was sprayed 19th December, 1922, 4th January, 1923, 17th January, 1923, 1st February, 1923, 15th February, 1923, 5th March, 1923, 12th March, 1923, 21st March, 1923, 3rd April, 1923, 18th April, 1923, and three times since. Three sacks of lime were broadcasted over the plot before planting. Each stool received a dressing of 1 lb. sulphate potash and ½ lb. nitrate of soda. The first bunchy top plant made its appearance on 17th January, 1923. I inspected the plot on 16th January, 1924. Twenty stools were completely bunchy and two more had unhealthy suckers.

The 100 plants in the check plot were put in on the 9th November, 1922. Fifty of them have had 1 cwt. lime and 1 cwt. basic super. applied to them broadcast. I inspected these on 16th January, 1924. Twenty-six stools were bunchy. The remaining 50 plants had no lime and no manure. I inspected these on the 16th January, 1924. Thirty-nine plants were bunchy. The progress of the disease in this plot was—

9th November, 1922	planted
17th January, 1923	7 bunchy
25th February, 1923	22 „
16th January, 1924	39 „

The comparison between Mr. Marks' treated plot and the check plot on 16th January, 1924,—*i.e.*, thirteen months after planting, was—

Check plot	65 plants were bunchy
Treated plot	20 „ „ „

The Government ran a check plot of 100 healthy plants against that of Mr. Marks at Mr. Tierney's plantation at Barney's Point; they were to be sprayed with kerosene emulsion on the same dates and in the same manner that Mr. Marks sprayed. Some of the plants were to be sprayed with nicotine sulphate instead of kerosene emulsion. This work was carried out by Mr. Bartlett, an officer of the Department. Mr. Bartlett's conduct was not entirely satisfactory, and he left the Department in June, 1923. On 28th April, 1923, he submitted a report in which he stated that out of 60 plants sprayed with black leaf 40 had turned bunchy, and that 8 plants out of 100 in the experiment parallel with that of Mr. Marks (spraying with kerosene emulsion and liming) had turned bunchy. I visited these plots on 24th January, 1924. Mr. Tierney stated that one after another of the plants had turned bunchy, and that those that remained healthy had shown such poor growth that he had decided to plough the land and plant sugar-cane. This he had done, leaving only a few of the most vigorous and healthy plants.

Other growers have tried spraying with kerosene emulsion. One of those who sprayed most consistently was Mr. Craven of Mullumbimby. I inspected his plantation in December, 1923. His plantation is on a hillside where there is a spring of water, so that the difficulty of water carriage is not present. On the 18th December, 1922, he planted 2,100 plants 7 ft. by 7 ft. apart, the suckers being derived from an old plantation showing a fair amount of bunchy top. He rejected 515 plants within one month for various reasons, and then replaced them. He sprayed every two weeks till the end of March. In May, about 50 plants showed bunchy top. In December, so many plants showed bunchy top that Mr. Craven abandoned the plantation. He had given up spraying some six months before. For the first few months after planting and during the earlier period of spraying the plants made remarkable growth.

When it was first suggested that aphides were the cause of bunchy top, I took two healthy plants that I had had growing in pots for eighteen months. A supply of aphides upon bunchy tops from the Tweed River district was procured, and the aphides were allowed to crawl off the unhealthy on to the healthy plants. Some were transferred by brushing them on with a camel hair brush. The aphides multiplied rapidly. A month later another batch of aphides from a bunchy top plant from the

Tweed River district was transferred to the plant. The aphides multiplied rapidly, and many of the leaves were covered with them. At the end of three months the plants began to look unhealthy but showed no signs of bunchy top. Gradually the plants died down and withered completely.

Thinking that perhaps these plants were too mature, aphides from a bunchy top plant have been transferred to a young Queensland plant that has just commenced to grow. The aphides have multiplied rapidly; they have been upon the plant for a month and are still under observation. So far the plant has shown a faint brown discoloration on the stem but no signs of bunchy top. This experiment will need to be repeated upon other plants.

I have made a number of observations upon the banana aphis (*Pentalonia nigronervosa*) in the field. They are to be found widely distributed both upon healthy and bunchy top plants. They are most numerous in wet weather, and their numbers diminish rapidly in dry weather. They inhabit chiefly the young leaves, just as they are unfolding, and the spaces between the sheath of the outer leaves and the pseudo-stem. They creep down into the ground for a considerable distance. They congregate upon the apices of young suckers before they have emerged from the ground.

Since a connection has been established between the leaf-roll disease of potatoes and aphides the banana aphis must still be under suspicion as a possible factor in the development of bunchy top.

If aphides are shown to be either the cause or the carriers of the disease I am of opinion that their control will not be accomplished by means of either a kerosene or a nicotine spray, because (1) the only aphides that are destroyed are those that come into actual contact with the spray, (2) in the positions which they occupy between the sheathing leaves and the pseudo-stem an air cushion, which it is impossible to penetrate, is formed as soon as spraying commences, (3) large numbers of them live underground, (4) very few plantations have any water near to them, (5) the constant spraying necessary to keep the aphides in check would make the labour cost excessive.

Effect of Kerosene Emulsion.

The sheathing basis of banana leaves that have been sprayed with kerosene emulsion fall away from the pseudo-stem in a marked manner, the angle subtended being very much greater than is the case in a normal plant.

In regard to the fact that at present the treated plot is more free from bunchy top than the untreated plot, the suggestion is hazarded that the constant watering has resulted in a preponderance of healthy roots, and that kerosene emulsion promotes root growth. (Some preliminary experiments that I carried out a few years ago upon quite another matter suggested this view.)

The banana aphis was first described in 1859, and is described by Froggatt in the "Agricultural Gazette," N.S.W., April, 1923.

Dust Treatment.

At the time that Mr. Marks' experiment was commenced, another grower refused to take delivery of 103 Queensland suckers. These were eventually obtained by Mr. Sutton after they had been exposed to the weather for two months. The scar caused by cutting would by this time have healed over. (This is noteworthy in connection with the possibility of a pathogene gaining entrance through a freshly cut surface.) All the original suckers died after being planted, and new corms were formed. The plants as they grew were dusted every two months with sulphur, so also was the ground around the plants and the sulphur raked in. One pound of sulphur was used per 100 plants. The previous history of the plot was (1) It had borne bananas for five years, which all eventually went out with bunchy top, (2) it was replanted with bananas which went out with bunchy top in the course of twelve months. I inspected this plot on the 16th January, 1924. Four plants only at this time had turned bunchy. A week later I was informed on the most reliable authority that two more plants had turned bunchy. The plants in this plot have made comparatively poor growth. Their future history may be carefully watched.

Mr. Wells, of Mullumbimby, planted 4 acres 7 ft. by 7ft. in December, 1922. His plants were selected from 4 acres of bananas which were going rapidly bunchy. The bulbs were dipped in kerosene emulsion before planting. He sprayed three times after the planting. He then started dusting his plants with sulphur and later with sulphur to which a little Paris green had been added. In his case the cartage of water to his plantation for spraying involved such an amount of labour

that he abandoned it and sought to find a deterrent. He claims that the mixture used has diminished the extent of the attack by aphides. They may have diminished from quite another cause—viz., the prolonged drought from which the North Coast suffered towards the end of 1923. I inspected his plantation in December, 1923. A number of his plants had turned bunchy.

Some plants upon Mr. Sutton's plantation, the soil around which was dusted with Bordaux mixture every two months, remained healthy longer than others but eventually succumbed.

Other Experiments.

Mr. Brooks, of Highfield, a few years ago announced that bunchy top could be cured by placing sulphur around the plants and chipping it into the soil. He and many others tried this method and eventually abandoned it..

Mr. Brooks then carried out the following experiment. Trenches were made by ploughing in such a manner as to throw up the soil upon either side until a deep V-shaped trench was obtained. This was then liberally manured with basic super.; the banana plants were set in the trench and the soil replaced and heaped around the corms. In this loose soil roots developed freely but the plants eventually turned bunchy.

There being some evidence that bunchy top originated by a rot setting up at the cut surface of a corm, Mr. Brooks has removed a number of suckers from apparently healthy plants, originally obtained from Queensland and now growing in the plot where the experiment with basic super. was carried out. Each of these corms has been smeared over the cut surface with Stockholm tar and planted. I inspected these plants in January, 1924; it is too early to report upon the experiment.

Mr. Brown, of Barney's Point, has carried out a number of experiments. His plantation has been kept absolutely free from weeds and has been well manured. Various manures have been tried, as also has liming, but the plantation is going out with bunchy top. He claims to have produced bunchy top by inoculating a plant with acetic acid. He now has a plot which he has treated with ammonium carbonate. The plot has not been under treatment sufficiently long to give any definite results. I visited Mr. Brown's plantation in January, 1924.

Of the various bunchy top cures claimed by Messrs. Clarke, Alioth, Selkirk, and others I have not seen any lasting results. It will often happen that a treated plant receives some sort of stimulus to which it reacts for a short period.

Manurial Treatments.

The Department has tried the following manures:—

1. 10 oz. super.;
   1 lb. blood.
2. 16 oz. potash;
   1¼ lb. super.;
   2 lb. blood.
3. 2 lb. potash;
   2½ lb. super.;
   4 lb. blood.
4. 1¼ lb. am. sulph.;
   1¼ lb. super.;
   1 lb. potash.
5. 1½ lb. blood;
   ¾ lb. am. sulph.;
   1¾ lb. super.
6. 2 lb. blood;
   1½ lb. super.
7. 2 lb. potash.

These were applied to rows of plants twice a year over a period of two and a-half years. They were tried at Mr. Radcliffe's plantation, Barney's Point (poor soil), Mr. Sutton's plantation, Terranora (medium soil), Mr. Pilgrim's plantation, Tweed Heads (good soil). They appeared to have no influence upon the incidence of bunchy top, which made its appearance here and there throughout the treated rows indiscriminately, and the majority of the plants

eventually went out with bunchy top just as if they had received no treatment. The manured plants bore more heavily than those that were unmanured, and the best results at the price appeared to be given by No. 4. It was not possible with the limited assistance available to get a comparison of yields; the fact that bananas may throw bunches at any period of the year renders this particularly difficult.

It is generally agreed that a potash manure is beneficial to bananas, since the following is the composition of the ash:—

	Per cent.
Silica	2.19
Lime	1.82
Iron oxide	0.18
Phosphoric acid	7.68
Magnesia	6.45
Soda	15.11
Potash	43.55
Sulphur trioxide	3.26
Chlorine	7.23

While I have seen no evidence of the application of a manure curing bunchy top, my recommendation to a grower starting a plantation would be to manure from the start in order that he might reap the maximum yield.

Mr. Deane, of Coraki, adopted this procedure. He ploughed his land, applied 15 cwt. of lime per acre, added 3 cwt. of Shirley's Banana Manure per acre, and then planted. I inspected the plantation in January, 1924. In spite of the drought of the latter part of 1923 the growth of the plants in fourteen months has been stupendous. A few are showing bunchy top.

I have treated two bunchy top plants in pots with the following mixture over a period of four months, and have not observed the slightest response:—

Potassium nitrate	2 parts
Sodium chloride	1 „
Calcium sulphate	1 „
Magnesium sulphate	1 „
Calcium phosphate	1 „

I am of opinion that a bunchy top plant is almost incapable of responding to a manure.

Laboratory Work.

Any pathologist investigating a new disease finds himself at once at a dead end unless he can test out the pathogenicity of a suspected organism. This has been my position.

Any organism regarded as being the cause of a disease must conform to the following well-known canons: (1) It must always be found associated with the disease, (2) it must be isolated in pure culture, (3) it must reproduce the disease upon inoculation into healthy subjects, (4) it must be again isolated from these in pure culture..

Only by having plants under control conditions in a glass house can suitable experiments on the lines indicated be carried out. I have frequently urged the necessity of being provided with such equipment and placed my views on the matter before the Select Committee on the Agricultural Industry in 1921. They reported, *inter alia*:—

> "The provision of several plant houses (glass houses) suitably heated with half an acre of land attached is recommended. This is the most urgent and pressing need of the biologist. He has no place in which to grow plants under pot culture conditions, where he can make the exact observations that are necessary in effective research. While a large sum is being spent annually on demonstration farms, this exceedingly important item in the work of research has not yet been provided. It seems obvious that when the State employs the services of scientific men to advise and to undertake investigation it should provide the pre-requisites for that work in the shape of equipment. Much of the work that the Biological Branch undertakes has to stop short at the very stage where culture work and microscopic investigation has revealed the desirability of proceeding further with infection experiments upon living plants under control in pots. To leave a botanist and plant pathologist unprovided with resources in this direction severely handicaps his work and retards progress. It is a penny-wise-and-pound-foolish policy which should be promptly remedied. (Final Report from the Select Committee on the Agricutural Industry, 191, p. 205.)"

I am happy to be able to report that a glass house 40 ft. by 18 ft. has now been erected in the Botanic Gardens for the use of the Biological Branch. It was completed in January, 1924. Adjacent is a shed where a steriliser, in which large pots filled with soil can be sterilised, has been fitted up and a small room where preliminary observations with a microscope can be made. I particularly suspect *Fusaria* and bacteria attacking the roots. Several organisms have been isolated. It is hoped to make fresh isolations from plants that have just turned bunchy, and to use mass inoculations of these organisms while they are in a virile condition and not weakened by sub-culturing. Two dozen healthy plants from Queensland are growing ready for experimental work; more will be obtained. I have not been able to convince myself after examining a large number of specimens that the internal tissues of the corm, stem, or leaves of a bunchy top plant are infected by bacteria or fungi as casual organisms. Those found have varied, indicating that they are secondary invaders. In advanced stages in wet weather even *Coprinus* sp. and *Myxomycetes* may be found upon bunchy top plants. Hence the necessity of examining plants that have just turned bunchy and obtaining material for experimental work from them. I propose to experiment with material obtained from the roots of these first. Bags of soil from an area badly infected with bunchy top and from an area slightly infected with bunchy top have been obtained. By filling pots with these and sterilising them and planting in them healthy bananas, and at the same time planting bananas in unsterilised soil in pots, it should be possible to determine whether or not infection arises from the soil.

Question of Dealing with Unprofitable Plantations.

There is a certain similarity between bunchy top and Panama disease. The microscopic symptoms of Panama disease—viz., dwarfing, wilting, sudden yellowing of the leaves, fracture of the leaves, and splitting of the pseudo-stem are quite different from those of bunchy top, but the appearance of the cross section of the corms of old diseased plants suffering from Panama disease given by Brandes (Banana Wilt. Phytopathology, Vol. IX., No. 9, p. 339) are identical with the appearance of old diseased corms of plants suffering from bunchy top. The roots in both cases are short and black. Brandes speaks of the "discoloured vascular bundles" in the corm, though from his description I should gather that he is really referring to the "ducts" filled with brown material to which I have previously referred. The figures which he gives of these discoloured vascular bundles which appear here and there in cross section of the pseudo-stem again represent exactly the discolorations to be observed in the vascular areas in cross sections of the stem of bunchy top plants. Panama disease was shown by Brandes to be due to *Fusarium cubense*.

He says that in regard to the prevention of the disease "Steam sterilisation was very effective, but it is needless to say that under present conditions this method is impracticable. Disinfection of the soil in small plots by drenching with copper sulphate, carbolineum, and formaldehyde was not only unsuccessful but the expense prohibitive. Other attempts to eradicate or render innocuous the parasite in the soil were worse than useless."

In Jamaica, the profitable life of a banana plantation is regarded as being about five years. Unfortunately, in the Tweed district it has been assumed that it would be much longer. Many plantations in the Tweed district have gone out with bunchy top, and it may be impossible to find a remedy as in the case of Panama disease. The problem presents itself—What is to be done with the land for which a high price has been paid? Tomatoes, passion vines, and beans (though very liable to black spot disease) may be grown and find a ready sale at high prices in Sydney early in the season, but later they meet the competition of fruit grown much nearer to the city. The completion of the Murwillumbah to Sydney line and the running of a fruit train has put the district nearer to Sydney by forty-eight hours than it was before, and there will be much money in early beans. The great desideratum in regard to passion fruit is a means of preserving the juice at full flavour and free from pips. People are so afraid of appendicitis that I doubt if a really large overseas trade could be worked up unless the extraction of the pips were accomplished. Sugar-cane could be grown on the land, but the Colonial Sugar Company will not buy cane unless it can be moved on barges or upon temporary rails on account of the cost of handling. Most of the banana plantations could not possibly be reached by barge or rail. The establishment of a Government sugar-mill is suggested by some. Some planters would be prepared to cease growing bananas on their plantations and farm elsewhere till the ground has had a rest or a remedy has been discovered for bunchy top. But if the ground is left fallow it will become covered with paspalum. Owing to the stony nature of the soil and its configuration, this will become absolutely ineradicable. It has been suggested that such abandoned plantations should be planted temporarily to lantana.

The question of dealing with land which has ceased to grow bananas profitably is one upon which some recommendations would be appreciated by growers.

Drought Effects.

A partial drought on the North Coast will often cause a check to the growth of a banana plant. If this occurs one or two months before a plant is about to throw a bunch, the plant being to a certain extent constricted at the apex, the rising bunch will be held fast. The true stem below the bunch continues to elongate, with the result that it becomes bent; in extreme cases it becomes S-shaped.

A prolonged drought occurred during the latter part of 1923. The effect upon some bunchy top plants was remarkable. Around some of the stools apparently healthy suckers sprang up when rain came, and I observed some bunchy top plants that had actually thrown three healthy leaves. In one case suckers were observed arising from the base of an old bunchy top corm that had been lying on the ground; these had formed surface roots, and although still attached to the parent, appeared perfectly normal. The drought would affect (1) A great diminution in the number of aphides, (2) a partial soil sterilisation.

Other Banana Diseases.

Anthracnose (*Cloeosporium* sp.), corm rots (where a corm has been planted immediately over the decaying root of an old tree stump or has been attacked possibly by *Armillaria melea*), and rust (due to thrips) have no apparent connection with bunchy top.

Occurrence of Bunchy Top in other Countries.

In October, 1921, Dr. Bryce (then in Ceylon, now Director of Agriculture in New Guinea) published a leaflet (Leaflet 18, Dept. of Agriculture, Ceylon) upon the Bunchy Top Plantain Disease. He records that the disease first appeared in the Colombo district in 1913 and then gradually spread. It attacked a plot of Manilla hemp in 1918. He records the disease as occurring in Fiji, Australia, Egypt, and the Bonin Islands. He found *Rhizoctonia* sp. on the roots. A preliminary experiment to determine whether the disease is caused by a filterable virus indicated that it is not so caused. It is stated that in the Bonin Islands bunchy top is attributed to deficiency of potash in the soil and that it has been found that application of potash manure greatly reduces the number of bunchy top suckers and even enables transplanted diseased suckers to recover. It is stated that it has been observed in Fiji that the Gros Michel banana is immune.

Dr. Butler, Director of the Imperial Bureau of Mycology, who attended the Pan-Pacific Conference, and who formed one of a party of which I was a member that visited the Tweed River district, has kindly sent to me an early report upon a disease that attacked bananas in Fiji and did much damage. From the description given there seems little doubt but that the disease referred to is bunchy top. If so, this disease appeared in Fiji in 1879. Dr. Bryce states that the plantain industry in Fiji was practically destroyed by bunchy top disease between 1890 and 1900. Bunchy top disease is present in Fiji at the present time. Mr. Beddoes, a Fijian planter, informs me that he has dealt successfully with it by (1) Ploughing out the corms and ploughing the land with a 28-inch. disc plough, (2) liming, (3) planting to some other crop for a year or more, (4) replanting with bananas. (*Note.*—Ploughing with any sort of plough is out of the question on a large number of the plantations in the Tweed River district on account of the configuration of the land and its stony nature).

Immune Varieties.

The principal variety grown in the Tweed River district is the Cavendish. I have seen other varieties (whether correctly named or not I cannot say) attacked by bunchy top. These are known locally as "Ladies' Fingers," "Gros Michel," and a banana from the Island of Moa.

A Mr. Sands, of Queensland, has lately stated that he has an immune variety of banana, the Vernon. Numbers of these have this season been purchased and planted in the Tweed River district. Partly because the beetle borer occurs in the Queensland district where they are grown and partly to supply the demand from a few plants, eyes rather than corms have been supplied to growers. The pared surfaces should offer an ideal area for the entry of a soil organism, and the plants reputedly immune will therefore be subject to a severe test. In January, 1924, I obtained two of these suckers from the plantation of Mr. Bentley, at Barney's Point, which had been planted in November, 1923. These plants were undoubtedly suffering from bunchy top disease when I obtained them.

Mr. Beddoes informed me that there was a variety reputedly immune grown in Fiji known as the "Middle Banana" or Vi-mia-mia. The Department may attempt to import a few of these suckers, taking suitable precautions to prevent the introduction of disease.

A variety, the Hansonian banana, reputedly immune, is being grown in the Tweed district this season. I have no particulars concerning it at present.

In any bunchy top plantation some plants will remain growing fairly vigorously long after others, and though affected will continue to throw small buches. Continuous selection from such plants is a method of evolving an immune variety that is worthy of trial.

G. P. DARNELL-SMITH, Biologist.

11th February, 1924.

YEERONGPILLY STOCK EXPERIMENT STATION.

A YEAR'S ACTIVITIES.

C. J. POUND, Government Bacteriologist.

Abstracted from the Annual Report of the Under Secretary for Agriculture and Stock (Mr. Ernest G. E. Scriven) to the Minister (Hon. W. N. Gillies) for presentation to Parliament.

Immunisation of Stud Cattle for Tick Fever.

In the course of the past year a total of 69 stud cattle were received to be immunised against tick fever. These animals comprised different breeds of bulls, cows, and heifers.

These animals all reacted satisfactorily to the inoculation of recovered blood, and there were no deaths.

Some of the animals were so susceptible that they reacted to a single inoculation, while others showed such a marked resistance that they had to be inoculated a second time, and in several cases a third time, before they responded. This clearly explains that the so-called mild and strong blood theory is a misnomer, for blood drawn at one time from a single animal (bleeder), when injected, in some animals produced a very severe reaction with high temperature and hæmaglobinuria, while in others a very slight or no reaction whatever was produced.

Pleuro-pneumonia and the Supply of Natural Virus.

This disease has apparently not been very prevalent during the past year, and in consequence the demand for pleuro virus was not very great. However, preserved natural virus was supplied for the inoculation of 8,910 head of cattle distributed in the following districts:—Mitchell, Morven, Charleville, Chinchilla, Augathella, Taroom, Warra, Fernvale, Kilkivan, Duaringa, Eidsvold, Helidon, Laidley, Toowoomba, Macalister, Longreach, Miriam Vale, Boonah, Murgon, Esk, Greenmount, Woodhill, Cooyar, Kilcoy, and Bowen.

All virus supplied is from natural cases of pleuro-pneumonia, and before distribution must have passed a microscopical examination to ensure its freedom from tubercle bacilli, septic bacteria, or any contaminating micro-organisms.

Notwithstanding that the pleuro virus supplied is free from septic bacteria, complaints are occasionally received that some of the animals inoculated suffer from bad tails. This is due to the fact that in these cases no precautions are taken to cleanse and disinfect the skin of that part of the tail operated on. The most satisfactory method of preparing the skin is to remove the hair with a pair of scissors, wash with warm soap and water, disinfect with 1-160 hycol, and finally, after an interval of about two minutes, remove the hycol solution by rinsing with water that has been previously boiled.

Very little extra time is involved in this work, particularly as the animals are operated on in a crush which holds ten or more animals, therefore, after the tail of the last animal in the crush is disinfected, the tail of the first animal is ready to be rinsed with water and inoculated. If these precautions are adopted, together with the use of sterile setons supplied by this laboratory, no "bad tails" should follow.

Supply of Blackleg Vaccine.

During the year 1,690 double doses of blackleg vaccine were supplied to stock-owners, distributed principally in the following districts:—Beaudesert, Gleneagle, Coomera, Eudlo, Laidley, Kingaroy, Eumundi, Beerwah, Brooloo, Murgon, Boorooren, Yeulba, Bell, Mooloolah, Morayfield, Kumbia, Harrisville, Gatton Crawford, Miriam Vale, Ipswich, and Gympie.

The vaccine prepared at this laboratory is of a uniform quality, and its reliability is proved by the fact that experimental animals, treated according to directions with a sample of each specially prepared vaccine, withstand the severe test of being subsequently inoculated with virulent blackleg bacilli and spores, while the inoculation of the same germs into control or unprotected animals causes their death in from three to five days.

Contagious Mammitis in Cattle.

This serious disease is continually being brought under notice through outbreaks occurring on dairy farms and the number of specimens of suspected milk being submitted for examination. The spread of this disease is attributed partly to the carelessness of the dairy farmer, who is not alive to its seriousness, or to the hygienic methods of controlling it.

The disease is a catarrhal affection, and limited in most cases to the delicate mucous membrane lining the milk-ducts of the mammary gland, and as a rule there is very little heat or swelling, moreover, the affected parts are not particularly painful.

The disease is caused by a tiny chain-forming micro-organism or streptococcus which attacks the mucous membrane, and, through the generation of its poisonous products or toxins, causes a rapid destruction of tissue-cells and leucocytes or white blood-cells which are attracted to the spot. These dead cells produce that peculiar feature of the disease, a yellowish purulent discharge or pus, which can be withdrawn from the affected quarter.

A specially stained specimen of the deposit examined under the microscope reveals masses of pus-cells with the characteristic streptococci.

In the acute form, the first symptoms of the trouble are a diminution of the milk-yield, a definite acidity of the milk, and a tendency for it to become rapidly coagulated. Gradually the milk assumes a dirty brownish colour and becomes more curdly, the amount of secretion from the affected quarter diminishing owing to the thickening of the ducts, which finally become impervious, and the whole quarter is rendered useless. It will be observed in some cases that the symptoms are so very slight that the milk does not appear to be curdled, and, on settling, the deposit is so small as to be overlooked.

In all cases where slight infection is suspected, a sample of cream as well as the first-drawn milk should be submitted for bacteriological examination.

Undoubtedly the transmission of the infection from cow to cow is through the agency of the milker's hands or the cups of the milking machine. This appliance, which was designed to enable the farmer to produce cleaner milk than by any other method, must be kept scrupulously clean, and be sterilised after each milking, and this advice is also applicable to the hands of the milker; moreover, all cows that are considered in any way suspicious should be milked last.

Once the disease has occurred in a herd, the owner should personally examine minutely every cow's udder before milking, and carefully note the character of the first small quantity of milk drawn. This precaution is especially necessary where a milking machine is in use, and any cow showing the slightest suspicion of disease should be held over to the last for milking, and on no account should the machine be used on her.

Treatment.—The injection of 6 oz. of a warm solution of 4 per cent. pure boracic acid through the teat into the udder immediately after milking is usually recommended for treatment. The solution should be injected at about blood heat, and allowed to remain in the udder for about ten minutes, during which time a gentle but thorough massage of the quarter is conducted, following which the fluid is withdrawn. This treatment should be applied twice daily for from three to five days, and then discontinued.

This method is only satisfactory in the very early stages of the disease, as during the first few days the streptococci are located practically solely on the surface of the mucous membrane, and have not penetrated far into the finer tubes which ramify throughout the delicate substance of the mammary gland. Gradually,

however, the germs penetrate deeper into the tissues and become englobed by cells and push further and further into the narrowing tubules. In this way it becomes impossible for any disinfectant fluid injected into the udder to reach the invading germs. Moreover, it will be remembered that the tissues of the udder are so extremely delicate that a poison sufficiently powerful to immediately destroy the streptococci is also liable to injure the tissue-cells.

The Use of Vaccine.—Both preventive and curative treatment has been carried out successfully by means of specially prepared vaccine. During the past year samples of milk were received from fifty-six cases of suspected contagious mammitis, and in forty-two cases the streptococci were detected by microscopical examination. Further, in each case the micro-organism was isolated, grown artificially in sterile broth, and an autogenous vaccine prepared and supplied to the respective applicants.

The vaccine is prepared by sterilising at a very low temperature (60 deg. C.) a flask containing an active young broth-culture of streptococci. An estimate is made of the bacterial count of the contents, which are then diluted so that each cubic centimeter contains 360,000,000 cocci and 0.5 per cent. trikresol added as a preservative. The standard dose each is 2 c.c. of the diluted vaccine, which is injected into the loose cellular tissue behind the shoulder, and repeated until some improvement is noticeable. Generally two or three injections are sufficient. In cases of emergency a stock vaccine is supplied, but the results are not always satisfactory, the greatest success being obtained by the injection of an autogenous vaccine—*i.e.*, one specially prepared from the organism causing the outbreak.

Practically every stock-owner who has had experience with vaccine prepared at this laboratory speaks of its efficiency most eulogistically.

Notes on Contagious Abortion.

It is most important, when an animal aborts, to determine if possible whether the abortion is infectious. Authorities agree that there are no symptoms by which this fact can be determined with accuracy, although the history of the case may be helpful in making a diagnosis. By means of an agglutination blood-test, the nature of the abortion or the presence of infection in the herd may be determined with a reasonable amount of accuracy.

During the past year, seventy-eight specimens of blood and five of milk taken from suspected cases of contagious abortion were received for the agglutination test. Positive reactions were obtained in twenty cases of blood and one of milk.

It is to be hoped that, as the reliability of the test becomes more generally known, breeders of stud and more particularly dairy stock will avail themselves of the opportunity of forwarding specimens for diagnosis, special attention being given to freshly purchased animals they intend to introduce into their herds.

Exhibits at the Royal National Show.

In the Departmental Court a special exhibit was arranged illustrating some of the many activities of the Stock Experiment Station. This was made up as follows:—

1. A collection of plate and tube cultures with charts, tables, and diagrams descriptive of the many advantages accruing from the use of scrupulously clean methods as compared with slovenly ways on a dairy farm, also the value of condensed or boiled water used in the washing of butter and dairying utensils, and the increased keeping qualities and value of butter made from pasteurised cream.

2. Maps, diagrams, and tables illustrating the method of tick eradication of U.S.A., and pointing out that originally in 1906 the area under quarantine restriction in consequence of the presence on cattle of the Texas fever tick was 728,365 square miles, which included fifteen States, covering the whole southern part of America from the Atlantic to the Pacific Coast.

   So successful has the work been that up to the present time considerably over 500,000 square miles or more than 70 per cent. of the original quarantined area of country has been freed from ticks and released from quarantine restrictions.

3. A collection of laboratory products, viz.—Protective vaccine for blackleg and curative vaccine for contagious mammitis and other diseases of bacterial origin, pleuro virus and sterile setons, lactic cultures, &c.

4. A collection of specially preserved and mounted specimens illustrative of the various manifestations of animal diseases, including tuberculosis of the various organs, glands, and tissue of cattle, pigs, horses, fowls, and turkeys; actinomycosis, showing affection of the jaw, tongue, flank, scrotum, &c.; pleuro-pneumonia, blackleg, swine fever, epithelioma, carcinoma, papilloma, &c.; also a collection of internal and external parasites.

In view of their educational character these exhibits attracted considerable attention, while members of the staff in charge of the exhibit were busily engaged each day answering questions of interested visitors.

Tick Dip Investigation.

During the past year considerable time was devoted to the following investigations conducted under the auspices of the Federal Institute of Science and Industry:—

1. To determine the action of standard arsenical dipping fluids on ticks during the moulting stages.
2. To determine by observation the protective action of arsenical dipping fluid against reinfestation of larval ticks applied to cattle after spraying.
3. To determine the effect of rain on efficacy of treatment with medicament.

The details of these experiments, with the conclusions arrived at, will shortly be published in a bulletin by this institute.

Summarised, these investigations have not demonstrated that improvement has been made on the American method of tick eradication, which insists that, within the area operated on, dipping of all cattle in a standard arsenical solution must be carried out every fourteen days, and be continued without a break until the larval ticks on the ground (which have not succeeded in getting on the cattle) die of starvation.

It has been shown that, after a single dipping, the larval ticks that may subsequently become attached within two days are invariably destroyed, while, of the larval ticks that may become attached three days after dipping, only a very few survive. Some of these die without ovipositing, others oviposit, but the eggs are infertile, while only a small percentage lay eggs which hatch, and the progeny (larval ticks) exhibit a noticeable inactivity.

With fortnightly dipping, the ticks on the treated cattle at the second and all subsequent dippings cannot be more than twelve days old, and therefore, before the second moulting stage, at which period some ticks appear to resist the action of the medicament. There are three reasons why fortnightly dippings have proved successful—

1. Ticks are more readily killed during the earlier stages of their parasitic existence.
2. It can be arranged that dipping day never falls on Saturday, Sunday, or market days, and whatever day is selected will be easy to remember.
3. In the event of wet weather several days remain in which the cattle can be dipped before the ticks drop off.

The New South Wales "Agricultural Gazette" for April, 1923, contains a report by Lionel Cohen, F.C.S., Chemist to the Tick Board of Control, on "Experiments with Arsenical Dipping Fluids."

These experiments deal with the effects of dipping fluids used in various strengths of 4 lb. to 8 lb. of arsenious oxide per 400 gallons of water, some animals being dipped while others were sprayed. The cattle (ordinary dairy cows) were naturally infested, and daily observation made for six days, presumably when they came in to be milked morning and evening.

In the conclusions drawn from the results of the experiments, it states: "The departmental dipping formula contains more arsenic than is required to produce the best results"; and further, "Cattle leaving quarantine might advantageously receive two dippings with a four-day interval in a 5 lb. solution, instead of with a five to ten day interval in an 8 lb. solution."

With a view of confirming the correctness or otherwise of this statement, the following experiment was carried out at Yeerongpilly.

Two naturally tick (moderately) infested cows were procured from a neighbouring farm and sprayed twice with an emulsified solution containing 5 lb. of arsenious oxide per 400 gallons, with four days' interval between each treatment. The animals were kept in stalls under observation for thirty days. Surviving ticks were removed for seventeen days after the second spraying. Of 48 engorged ticks removed, 18 died without ovipositing, 30 oviposited, 13 of which laid eggs which hatched.

This experiment proves that, had these two cows gone into clean country immediately after the second treatment, they could have introduced sufficient active ticks to set up a centre of infestation.

TOWNSVILLE STOCK EXPERIMENT STATION.

A YEAR'S REVIEW.

JOHN LEGG, B.Sc., B.V.Sc., M.R.C.V.S., Director and Government Veterinary Officer.

Abstracted from the Annual Report of the Under Secretary for Agriculture and Stock (Mr. Ernest G. E. Scriven) to the Minister (Hon. W. N. Gillies) for presentation to Parliament.

During the past year visits have been paid into nearly every stock district in connection with outbreaks of contagious diseases amongst stock. It cannot be said that outbreaks of contagious and infectious diseases have been more numerous during the past year, although pleuro-pneumonia contagiosa of cattle has been found just recently in the coastal districts.

Dry conditions prevail everywhere at present, and have been with us for the last twelve months. Recent visits in country districts have indicated that cattle everywhere are in poor condition.

Stock Experiment Station.

The equipment of the Experiment Station has been added to during the last twelve months, and the facilities for working are greatly improved as compared with past years. The station can now undertake the examination of simple bacteriological and pathological material, and sufficient equipment is also available for ordinary chemical analyses.

Immunisation of Cattle against Tick Fever.

During the past year there has been a marked falling-off in the number of cattle received at the station for immunisation against tick fever. Only 34 head were received as against 79 for the previous year, and 191 again for the year previous to that. The mortality for the year has been very high, 7 head of cattle dying. These included five which died of poverty. No deaths were due to redwater. All those cattle which died of poverty were the property of the one owner, and were brought from the South at the end of the dry period of last year. They withstood the redwater inoculation, and it was only some time afterwards that deaths commenced to take place. It was the poorest of the cattle that died, and nearly all had young calves.

Otherwise there was one death (a bull) from traumatic pericarditis, a piece of nail having passed through the reticulum and diaphragm into the thoracic cavity; and one death from fatty degeneration of the heart-muscle.

In the course of the last three years, a total of 328 head of cattle have passed through the Experiment Station. The deaths from redwater reach a total of 6, while deaths from other causes total 13.

In routine inoculation of cattle, interesting points are sometimes brought during the course of a reaction. It is known that all animals do not react exactly alike, either in the type of temperature curve produced, the blood changes which follow, or the time of appearance and disappearance of the casual organisms in the blood.

The reaction largely depends on the susceptibility of the animal concerned. Nevertheless, where animals have been inoculated in numbers, it is found that variations occur in the type of reaction produced, such variations depending upon other factors than the particular susceptibilities of the animals concerned.

The work carried out by the Chemist will be found in the appendix attached. It will be found that there has been a considerable falling-off in the number of dip samples sent in for analysis.

Types of Redwater Reactions.

In vaccinating animals against any contagious or infectious disease, the resultant reactions depend on three factors—the susceptibilities of the animals, the dosage, and the strength of the vaccine. In vaccination against tick fever in cattle, what is really a natural culture of the specific organism is used. Blood containing the organism is withdrawn from an immune animal, a little sodium citrate added to prevent coagulation, and this citrated blood constitutes the vaccine. Within limits, the size of the dose used seems to have no effect on the subsequent reaction, and if a group of animals are inoculated together, with doses of blood, say, varying from 5 to 50 c.c., it is usually found that the resultant reactions are more or less alike.

The strength of the vaccine is an unknown factor. It is usually found that the reaction produced by one immune animal's blood is much the same as that produced by the blood of another immune animal, though it cannot be denied that a survey of the records of a large number of animals inoculated frequently reveals the fact that most of the deaths will be found to follow the use of blood from one or two particular animals.

It is possible, of course, that, by a coincidence, the blood of one or two particular immune animals has been used on the most susceptible animals, but this factor tends to be ruled out when a large number are considered.

Apart from the above variations, all of which might be met with in routine inoculation, there is another variation which sometimes occurs. This is best illustrated by the following two series of inoculations, both samples of blood used being from the same animal (Bleeder B), though drawn at periods of nearly two years apart:—

FIRST SERIES.

Date Inoculated, 21-6-21.

Animal Number.	Result.	Remarks.
	Number of days between Inoculation and appearance of Organisms in Blood.	
47	8	Typical reactions in all cases.
48	8	
49	8	
50	9	
51	9	

SECOND SERIES.

Date Inoculated, 18-4-23.

Animal Number.	Result.	Remarks.
338	Organisms absent	Reinoculated 9-5-23 with blood of D.
339	Ditto	
340	Ditto	Reinoculated 9-5-23 with blood of G.
341	Ditto	
342	Ditto	Reinoculated 9-5-23, 10c.c. blood from H.
343	33rd day after inoculation, organisms absent	
344	Organisms absent	

The first five bulls inoculated in 1921 all passed through typical redwater reactions, the temperature rising anywhere between the sixth and tenth days, the organisms appearing about the same time and remaining in the blood a few days, then the temperature subsiding and the organisms disappearing also.

The second series of animals show quite a marked difference. There was a rise in temperature in all cases about the usual time, and the organisms failed to appear in the blood and had made no appearance twenty-one days after inoculation. In conformity with the usual custom practised here, animals which have not reacted, or those which have reacted doubtfully—and these being considered doubtful—are reinoculated with the blood of a second immune animal twenty-one days after the first inoculation. Nos. 338 and 339 were reinoculated with blood of D, Nos. 340 and 341 with blood of G, and Nos. 342, 343, and 344 with blood of H. For the seven following days the animals were run in the paddock, where they showed no signs of illness, and then smears and temperatures were recommenced.

Every one of these animals on the twenty-eighth day after the first inoculation, and seven days after the second, showed marked blood changes, far more than are usually found following inoculation for redwater. Granular basophilia, nucleated red corpuscles, anisocytosis, and polychromasia were all very marked.

The blood showed all these features, while in addition No. 343 showed numerous piroplasms as well. How are these changes to be accounted for? The second series of inoculations are complicated by the fact that a second inoculation had been carried out in each case, but it is thought that the occurrence of organisms in the blood of No. 343, and the blood changes in the whole five, were most likely due to the first inoculation and not to the second. The argument in favour of this is that blood changes do not usually commence after so short a period as seven days, while on the other hand organisms may be sometimes found weeks after inoculation. Even were it contended that the marked blood changes occurring in the blood of these animals were consequent on the second inoculation, the result is equally remarkable. It rarely happens that marked blood changes occur so often as a week after inoculation at any time, and with the blood of any immune animal, while here were a whole series all showing these blood changes.

The two series represent two different types of reaction, the first being the most frequent, therefore, perhaps, the typical, where the temperature reaction coincides with the appearance of the organisms (7-14th day), the second atypical, where the temperature reaction does not coincide with the appearance of organisms in the blood, but is followed some weeks later by marked blood changes and may be then the appearance of piroplasms.

Since these two series were inoculated with blood from the same animal, it follows that there had been between the dates mentioned some alteration or change in the virulence of the blood of Bleeder B. Whether this change was a result of the animal being kept free from ticks over by far the greater period of time between the dates mentioned, or whether this change in virulency depended on the age of the animal, it is impossibleto say. Perhaps both factors operated.

Pleuro-Pneumonia Contagiosa of Cattle.

A note is made here in connection with this disease, firstly, because of its prominence in the North, and, secondly, because of the many erroneous ideas which exist, both regarding the means by which this disease is spread, and the means of inoculation used in its suppression.

The disease in North Queensland shows little tendency to assume the epizootic form. It exists as an enzootic. Outbreaks are, as a rule, associated with the appearance of a few acute cases, and an equal or larger number of chronic cases, while the majority of animals do not seem to be affected. That the majority of cattle are not affected is borne out by abattoir inspection.

The insidious nature of the disease makes it very difficult to deal with, and the difficulty is further enhanced by the failure of some stock-owners to report the occurrence of the disease in their stock, particularly in those cases where only a few head are lost. What frequently happens is that an owner kills an animal in the acute stage of the disease, draws off sufficient pleuritic fluid to inoculate his herd, and that is all that is done. The consequence is that usually the acutely affected animals die, while chronic ones remain affected, maybe for months, and then also frequently die or appear to recover. It is these chronic cases, or the so-called recovered animals, that are such a serious factor in the production of fresh outbreaks, particularly as many of these animals appear to be quite healthy. To eradicate the disease under such conditions appears to be almost an impossibility. Quarantine measures which are put into operation during outbreaks of this disease seem to have but little influence in suppressing the trouble among station cattle on the run, but they are of much more value where the disease occurs in mobs of travelling cattle.

The disease is caused by a minute micro-organism which is just within the limits of visibility of the highest powers of the microscope. It spreads from beast to beast by contact. Many stock-owners are still of the opinion that the disease arises spontaneously, and will point to the fact that in the wet years of 1917 and 1918 the disease appeared on many runs where it had not been seen for years, and where there had been no movement of stock on or off the run for some time previosuly. Whether the humidity of the atmosphere facilitates the spread of the disease is unknown, but the fact remains that outbreaks have recently occurred in the coastal region of the North, and these during the driest period on record.

In vaccination against this diesase the usual method employed is to pass a small woollen seton soaked in the pleuritic fluid from an acute case of the disease through the end of the tail. This pleuritic fluid contains the causal organism, and this latter finding a suitable medium in the subcutaneous tissue of the tail, commences to multiply. A swelling results, and in a typical case of the disease reaches the size of an egg, or a little larger, and then disappears. The animal is afterwards found to be immune. It occasionally happens that the swelling passes upwards along the

tail, and if neglected reaches the buttocks. There is then growth of the virus in the subcutaneous tissue of the hind quarter, often followed by gangrene of the part. Death often supervenes as a result of toxæmia, but where this does not occur there there is a sloughing of the part followed by gradual healing. Where the swelling is spreading upwards, if the tail is removed before the buttocks are reached, the animal usually recovers and is found to be immune.

Unless an animal shows any swelling of the tail after inoculation, it can usually be deduced that there has been no reaction, and this is found to occur in many animals, possibly because of the possession of a strong natural immunity.

The insertion through the tail of the seton is usually performed by means of a special needle. One drawback to the use of the seton is that there is usually a small amount of hæmorrage in the area, and this, soaking into the seton, helps to dilute and wash out the organisms. Further, as the wound caused by the insertion of the seton is by no means aseptic—in fact far from it—if the tail is examined a few hours afterwards there is always a serious oozing, and this also helps to remove the few drops of virus in the seton. By far the better method of inoculation is to insert a few drops of virus under the skin at the end of the tail by means of a strong hypodermic syringe, but, as many cannot use a syringe properly, the more simple method of the seton is universal.

One of the most erroneous notions that exists in regard to the vaccination of cattle against this disease is that, where a large percentage of swollen tails occur after inoculation, such is due to the carelessness of the inoculator in injuring one of the bones at the end of the tail. It could only be gross carelessness on the part of the inoculator should such occur, and furthermore, even if the bone is deliberately touched with the needle, as a rule no untoward effects follow. Where a large number of swollen tails occur, it can be assumed that the inoculation has been successful and the animals will afterwards be found to be immune.

Impaction Paralysis of Cattle.

This disease, an account of which appears in the "Queensland Agricultural Journal" for May of last year for the first time as far as Queensland is concerned, is found to occur in certain areas in the Charters Towers district. Since then, although no actual cases have been seen in other parts, from accounts which have been received there appears to be little doubt that this condition is in no way confined to the areas where is was first discovered.

The condition is apparently akin to the "impaction paralysis" of Victoria, the "dry bible" of South Australia, and resembles in some way the "lamziekte" of South Africa.

It was held for many years that the "lamziekte" of South Africa was probably a form of deficiency disease, and many experiments were formed in an attempt to throw light on the disease from this particular point of view. Similarly, in parts of Australia it was believed by many that the disease was also of the nature of a food deficiency. Recently, work by Theiler in South Africa and by Seddon in Victoria has thrown considerable light on the disease. Their experiments have shown that the disease is in all probability produced as a result of the ingestion of powerful bacterial toxins. These toxins are produced in the carcasses of animals lying dead in the open, and they are introduced into the body of the affected animal as a result of the bone-chewing habit. It is well known that the bone-chewing habit is common—in some cases very common—in areas where the disease is prevalent, and it is because of this habit that the condition has been ascribed to some deficiency in the natural herbage.

All the information that the writer has been able to gather appears in the issue of the journal referred to above, and it seems unnecessary to repeat it here. It was there suggested that, the disease probably being caused as a result of the ingestion of bones, all carcasses on an affected run should be burnt out, and that lime should be supplied in troughs. This has been carried out in one small area, and there appears to be a marked decline in the mortality. On the other hand, it is a big problem to commence burning up all carcasses on a large badly infected run, especially as most cattle stations are now working as short-handed as possible.

As the disease in other parts appears to be the result of ingestion of bacterial toxins, investigation along these lines is required in Queensland.

Dip Concentrates.

Two samples of different proprietary preparations, recognised by the Department, were found to be much below the specifications set out thereon, with regard to the arsenic content.

General Analytical Work.

It was hoped that general analytical work would be performed on the completion of the new laboratory, which has been fully equipped for same, but such has not yet been sanctioned. It should be immediately made known that the chemical analyses of many different products can be carried out in the Townsville Laboratory, and this work, with the collaboration of the Council of Agriculture, should be significant.

Parasites of the Pig.

In the report for 1921-2, the discovery of two nematode parasites was recorded. These were *Necator Americanus* and *Ankylostoma duodenale*.

It is now necessary to place on record the further discovery of two other nematode parasites, both from the stomach of the pig.

It had been frequently noticed by the slaughtering inspector of Townsville (Mr. J. A. Rheuben) that certain pigs at the abattoirs were found to be in poor condition. These pigs were fed under similar conditions to other pigs arriving in prime condition, and there appeared to be no reason for the poverty, until it was discovered that these animals were infected with small nematodes in the stomach and duodenum.

Specimens were collected and forwarded to Dr. Georgina Sweet, Associate Professor of Biology, Melbourne University, who writes that the specimens represent two species of nematodes. They are *Arduenna Strongylina* and *Physocephalus sexalatus*.

The former has been already recorded in Australia, but it is not yet known whether the latter has yet been recorded. Credit for the discovery of these parasites is due to the slaughtering inspector, and if all inspectors could be induced to work so assiduously as this officer there is no doubt that valuable information could be obtained, as officials engaged in slaughtering work are in a unique position in having so much material passing under their eyes.

A NEW COTTON PEST.

By J. H. SIMMONDS, B.Sc., Entomological Staff.

Investigation following the report of a pest attacking cotton in the Woolooga district showed the insect concerned to be a Chrysomelid beetle, *Rhyparida australis* Boh. (A few specimens of another Chrysomelid, *Geloptera seitula* Lea., were also found on the cotton, but probably played a very minor part in the injury.) This beetle is a fairly common insect to be met with in Queensland, and has been found by Mr. Hacker in large numbers under the bark of Eucalypts. The attack at Woolooga was quite localised, as cotton three-quarters of a mile away was not

PLATE 36.—RHYPARIDA AUSTRALIS.

affected. It is, therefore, to be regarded at present only as a secondary pest, some local conditions having evidently given rise to the production of enormous numbers of the insect which found in the cotton a suitable, though probably unusual, host plant.

Rhyparida australis is a small dark brown to black beetle, 5½ to 6 mm. long, or about 7/32 inch. The margins of the wing covers are parallel at the sides and rounded posterially. The prothorax and head form a bluntly triangular shape. The antennæ are brown, long and filliform and arise just in front of the prominent black eyes. The prothorax is black and is covered with minute punctures visible only with a lens. The wing covers have an irregular and variable black area towards the outer side and a black margin to the inner edge. Between these two runs a longitudinal brown band joining with a lighter brown area round the apex. On the wing covers are regular longitudinal rows of striæ, the punctures forming which are larger than those on the prothorax. The legs are brown, darkening towards the joints.

It was stated that the beetles were not noticed in the field on the 24th December, but were plentiful round the lamp on that night. On the 27th they were in the field in great numbers, more especially on the north and west side working round the edge with fewer towards the centre. In bad parts a plant about 1 ft. high might have as many as twenty to thirty beetles upon it. Plants four to six weeks' old were the first and most severely attacked, and to a less extent some two months old. Plants under three weeks were not attacked, the reason for this not being apparent. The beetles were a serious pest for about a week and then diminished greatly in numbers, perhaps owing to the fact that a cold snap occurred at that time, and also they were disturbed in the process of thinning out the cotton plants.

Damage.

The beetles were able to do a great amount of damage owing to their method of feeding. They eat round the soft outer tissue of stems on leaf stalks, circling the stem perhaps only in a narrow band, but sufficient to ringbark the lateral shoot or leaf and cause it to wilt, hang down, and die. Little damage is due to the consuming of the leaf itself. In bad cases the plants are defoliated entirely, only the main stem being left and dying, while in other cases, though practically defoliated, the plant is able to send out new lateral shoots. In larger plants, which had been more or less cut back, bare stumps project which would otherwise be lateral branches, and the terminal shoot is usually destroyed. To replace those lost new lateral shoots grow from the main stem at the base of the cut-off branches. The stems and leaf stalks show erosions. The effect is to give the plant a ragged and deformed appearance as well as a severe setback in growth. Recent damage is seen in the form of a lateral shoot or leaf wilting and hanging from its stem at the point cinctured by the beetle. In confining its attack more especially to those places mentioned above, this beetle is distinct from *Monolepta rosea* which is essentially a leaf eater.

Habits.

The beetles feed at night. During the heat of the day they rest under the leaves and among the terminal shoots. They have also been found in numbers under loose clods of earth in the ground. They are detrimentally affected by heat, since if they happen to fall on their backs in the sun and are prevented from regaining their feet they will die within a few minutes. The beetles are dislodged from the bush by a sharp jar. They appear to be more easily dislodged and more disposed to flight in the evening than during the day.

Control.

Kerosene flares, such as are used for *Monolepta rosea,* can be used for the destruction of this beetle. In this case flares were tried as soon as the beetles were noticed. Thousands flew to the light and were killed, and probably half the population was thus accounted for. To be most effective, large flares should be used and carried between rows, at the same time beating the bushes on each side to dislodge the beetles which will then be attracted by the light and fly into the flame.

Plate 37.—Recent Damage to Lateral Shoot and possible Leaf Injury.

PLATE 38.—BADLY DAMAGED PLANTS.

Plate 39.—Plant showing Growth of New Terminal and Lateral Shoots after having been Cut Back.

BREEDS OF PIGS.

E. J. SHELTON, H.D.A., Instructor in Pig Raising.

This series commenced in the November Journal with an article on the classification of pigs. In the following number the points of the Berkshire were set out; in the January issue the Tamworth was fully described, and last month the characteristics of the Middle Yorkshire breed were noted. In succeeding issues other breeds of pigs and matters of moment to pig raisers generally will be discussed.—Ed. "Q.A.J."

THE POLAND-CHINA—AN UP-TO-DATE AMERICAN TYPE.

Special Note.—In describing this, one of America's leading types of pigs, it must be understood that the reference is to the more recently introduced types, and not to those old spotted types one sees occasionally in different districts here in Queensland. These old types are now out of date in so far as their usefulness for the purpose of stud-breeding is concerned, they are also invariably coarser and less profitable than the types described herein, whilst it is impossible to trace their breeding or to record their pedigrees. On the other hand the modern type of Poland-China is up-to-date in this, as in every other respect.

It would not be correct in view of the above statement to classify our Poland-Chinas as belonging to two special groups or types such as might be referred to as Poland-Chinas and Improved Poland Chinas, but it is correct to state that the Poland-Chinas referred to in this article are a decided improvement on the types of fifty years ago, and it is anticipated now that they will become much more popular as time goes on and breeders generally learn to appreciate their special and valuable qualities more than they have done in the past.

How the Poland-China Originated.

Apart from the several breeds of pigs originating in the British Isles from the old English wild pig crossed on to the Chinese and Neapolitan types, there are

PLATE 40.—A PHOTOGRAPH OF THE OLD AMERICAN RAZOR-BACK SOW, NOT UNLIKE MANY OF THE WILD PIGS OF NORTH WESTERN NEW SOUTH WALES AND QUEENSLAND.

When photographed this Sow was five years old and weighed 150 lbs. live weight.

numerous other breeds and types worthy of note that have been evolved in other parts of the world, and of these the American types are perhaps the most widely known and distributed. Prominent amongst these is the Poland-China, which originated in the Miami Valley, Ohio State, in the counties of Butler, Hamilton, and Warren.

While the improvement of various types of animals was taking place in Great Britain our "Yankee" brethren looked on, took notes, and eventually decided to try if something could be done in the way of improving the wild razor-back type, of which America and Canada apparently had an unlimited supply. As far back as 1816 there is a record of this attempt to improve the old Byfield and Russian hogs by crossing them with an imported type then known as the "Big China," a breed specially introduced for the purpose by one John Wallace, a leader of a sect of people known as "The Shakers." These "Big China" pigs were white in colour and were noted for the fine quality of their flesh and for their comparatively quick growth.

Later in the year 1834 an Irish type of pig—known as the "Irish Grazier"—resembling the old English Berkshire, was introduced into Ohio State, and the progeny of these pigs when mated with the native hog were so favourably commented on that the Berkshire type, as it was then, was, as opportunity offered,

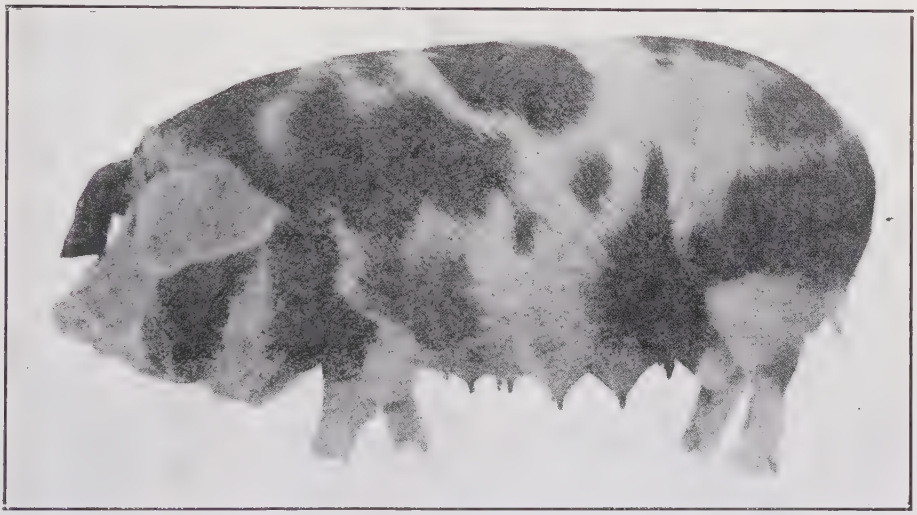


Plate 41.—A Sow of the very old type of Poland-China still seen in parts of Queensland, and until recently Exhibited at several of the Leading Shows.

freely introduced and used liberally for crossing on the partly improved stock available.

During the period 1816 to 1845 several other breeds and types of hogs were brought into south-western Ohio and were used in the building up of the breed, including the Irish Grazier, a medium-sized white hog with ears erect and with characteristics of smoothness and early maturity, and the Siamese, a small black hog of very early maturity. The Berkshires, introduced about 1839, were very large hogs "of even top and bottom lines, with good feet, not much depth of body, and drooping ears." These hogs were red and known in Ohio as Berkshires because their ancestors came from that part of England.

Other so-called breeds mentioned as having been used to a greater or lesser extent in the making up of Poland-Chinas were the Bedfords, or Woburns, the Byfields, Neapolitans, Russians, and others. These were not well-defined breeds such as exist to-day, but were terms used to designate certain kinds of animals with more or less variation in type.

It is claimed by the Poland-China Breed Promotion Committee of U.S.A. that the world's first real "corn belt" of commercial importance was in that region of south-western Ohio known as the Miami Valley, in which one of the principal problems presented to the farmers of that section was the production of a hog that

would best convert the abundant corn crops into pork and carry it to market. It is not likely that the men who assisted in the development of this breed had in mind a definite type of animal as the final result of their breeding operations; it was the corn belt and the corn-belt environments that determined the ultimate type. No one type or breed used in the moulding of Poland-Chinas exerted a predominating influence, but about 1850, when the process was considered complete, the result was a hog such as had never existed in the corn belt before. This hog was the product of the corn belt and of the constructive efforts and commanding genius of the farmers of that section. The claim has been made by those familiar with what took place that no new blood (*i.e.*, blood of other than the Poland-China breed) was introduced into the breed after 1845. By that time it had come to be well recognised as a breed, although it was known for some time by several different names, such as the Warren County hog, the Miami Valley hog, the Magie hog, and others.

The name "Poland-China" was officially adopted in 1872 at a convention of hog men held in Indianaopolis for the purpose of naming the breed. The word "Poland" is generally thought to be a misnomer. Some of the hogs that were used in the making up of the breed were known as Poland hogs. This led to the belief that they were descended from hogs imported from Poland. The facts of the case, as stated by the Poland-China Breed Promotion Committee, are that one of the most successful and outstanding hogmen of the period around the year 1840 was Ascher Ascher, a Polander by birth, who lived in Butler county, Ohio. He brought no hogs to that locality but was able to produce a superior class of hog from the material at hand, and sold a great many boars. His pigs were known as Poland hogs, and this formed a part of the breed's present name. Until 1870 the breed was largely described as dark spotted. Soon after, the fashion or fancy changed, and in a few years the breed was to a very large extent black with white points, and this is the prevailing preference to this time. No hard and fast rule is enforced as to the white points, and few breeders will discard a good animal because it has a little extra white on it. The first Poland-China record was established in 1877. Within three years two others were started and later the breed had six records. These have been reduced to three at the present time. Joint action of these three records for united breed promotion started in 1920, and is the most hopeful promise of the breeds future welfare. In Australia, Poland-Chinas are catered for, in so far as Herd Book registration is concerned, by the Berkshire and Yorkshire Society of Australasia, in whose Herd Books quite a large number of Polands have been registered. This society, which is controlled by a Federal General Council, has branch committees in each of the several States of the Commonwealth, so that Poland-China breeders desirous of registering their stock should get in touch with the local secretary in order to obtain full details.

In America an attempt was made some years ago (and with considerable success) by a number of breeders to retain the qualities of the original type under the name of the Spotted Poland-China, and since then this type has been developed to such an extent as to be quite distinct from the Poland-China proper; but these Spotted Polands have never attained the same popularity, nor have they been distributed to the same extent as the Poland-China proper. Even of the last-mentioned type, in America, there is two separate classes—one, the big-boned, growthy, lard type; the other the medium bacon or pork type, similar in colour and shape but distinct in size and development of bone. The types common in Australia are of this latter medium bacon and pork class, the former type has not yet been introduced.

As we have them now it is proved that success can be attained only by allowing them to have considerable range and by forcing them to take exercise freely every day. They should be given a variety of foods, not too liberal in quantity but of good quality. They have comparatively small appetites and have wonderful powers of assimilation, but unless they are judiciously handled and compelled to take exercise freely in these warm climates, they become sluggish and excessively fat. They must be allowed ample shade and fresh cold water, as they cannot stand continuous dry heat. They likewise require protection from the cold winds of winter and should be given adequate accommodation at all times.

Special care should be exercised to have the animals in proper condition at mating and at farrowing time—they must be in medium condition only, not too fat nor too thin and worn. They must at all times be carefully bred and fed, and it is wise to introduce fresh blood occasionally, as the type is inclined to deteriorate unless properly attended to. Special care should likewise be paid to the selection of breeding stock from large, thrifty, sturdy litters correctly marked and shaped and of proved vigour.

Poland-Chinas were first introduced into Australia about forty years ago by one William Marks, but records showing from where the type came appear to have been

Plate 42.—Poland-China Sow, "Sylvia."

Plate 43.—Poland-China Boar, "Penates."
Age, 7 months. Weight, 181 lb.

These two photographs represent the type of Poland-China common in New South Wales 30 years ago.

lost. One of the early breeders, and who still handles this breed, is Mr. G. H. Gray, of Federal, Richmond River, N.S.W. Writing concerning his experiences, Mr. Gray says:—"I have been a breeder of pure-bred Poland-China pigs since 1882, and have never in-bred my stock. Have never had a Poland condemned on slaughter, and have sent pigs of this breed to the bacon factory for over twenty-five years. Am still breeding and selling boars and sows and sending them all over the State. I bought my first Polands from T. H. Davey. He got his pigs from A. M. Woodhouse out of imported American stock about 1882, and in 1885 I bought a young boar from A. A. Dunnicliffe, of Burrawong, New South Wales. The sire of this pig was 'Crown Prince Imported,' his dam being called 'American Imported.' The records of his breeding also appear to have been lost, although it is understood that he was of the 'Magie' strain bred by D. M. Magie, of Butler County, Ohio, for in those days pedigrees were not as carefully preserved and recorded as they are now nor were there any record associations for pigs in Australia."

Probably the earliest importations of value in improving the type of Poland-China in Australia were those made by the New South Wales Government about twenty-five years ago. These, at any rate, were the first to be recorded, and prominent amongst these was the boar named after that famous American Statesman and President, Abraham Lincoln. Another boar imported at the same time was called "Roosevelt." He also came from the Flossmoor Stock Farms, Illinois, and although not as true to type as "Lincoln," he left a lot of very useful stock in the studs in which he was used, principally at the Hawkesbury College.

Many years before this there was a boar imported whose name was "United States." He also appears to have come from the Flossmoor Farms, but his pedigree also has been lost. The boar "Abraham Lincoln" was the best Poland ever introduced into Australia prior to 1912. It was in that year that the New South Wales Government made a further importation for the Hawkesbury Agricultural College stud; these were high-class pigs, and it was the progeny of these importations that are recorded as the parents of most of the Polands we have to-day. Prominent amongst the animals forming this shipment was the boar called "Manager," 177881, bred by Jno. Francis and Sons, of Illinois. Amongst the sows in this same shipment was one called "Chicago's Pride," another sow was named "Iowa Beauty," still another was known as "Missouri Girl," whilst the other two were named "Winconsin Pet" and "Kansas Pearl." Two sows, which formed part of the shipment of which the boar "Manager" formed a part, were named "Ohio Beauty" and "Ohio Gem," but neither of these sows were successful breeders, therefore none of their stock have been recorded.

Probably the most useful boar we have ever had, so far as a sire, was the boar "Sydney," 228381, bred by J. G. Drennan, of Chicago. This boar was imported in 1913, and was an active, serviceable animal until quite recently. He has sired more Poland-Chinas than any boar it has been Australia's good fortune to import, and was the best and truest specimen of this now famous type. A fellow voyager from the U.S.A. in 1913 was a boar named "Judge K," bred by J. S. Kemp, of West Kenney, Illinois. He was sired by a boar called "On the Dot," 106355, and was from a sow, "She's a Honey," 403940. He represented a less prepotent type, probably more suited to the State's trade than to the markets of the South of Queensland. "Judge K" was, however, a good investment, as he left a host of useful pigs behind him, and it is the progeny of these two boars mated with representatives of the earlier importations that have been distributed throughout Australia.

More recently still Messrs. Wilson and Keppie, of "Woodlands," Paterson, New South Wales, have come to the rescue of Poland-China breeders and have imported several first-class animals from Canada. These have developed into very fine specimens of the breed, and their progeny are now being distributed; they are distinctly unrelated to the types formerly imported and are therefore filling a very useful purpose in the breed.

The great call in Queensland is for a medium type pig that will grow into a prime bacon pig, dressing from 110 lb. to 130 lb. at six months of age. These same pigs would weigh round about 300 lb. live weight at twelve months old if they were forced on to those weights, but we find it unprofitable to exceed the 130 lb. dressed limit, and the tendency is now to reduce this weight to 120 lb. dressed, as representing the most profitable sale weight.

For the production of medium-weight porkers, weighing about 70 lb. dressed at four and a-half months old, the Poland-China is an ideal type, but there is not a great demand for pork in Queensland, hence we find the Poland-China more useful for crossing with the Berkshire grade or even with Tamworth grade pigs. A Poland-China boar mated with these types gives excellent results. Poland-Chinas are destined to become one of the most profitable of all breeds, provided they maintain a fair standard of proficincy and do not become too coarse or heavy. As a

breed they are not noted for great prolificacy, and an average litter of eight must be considered good, but they have acclimatised well and appear to be more prolific under Australian conditions than they are in their native home. However, they possess a wonderful aptitude to fatten readily on a comparatively small amount of food, whilst they are easy feeders and contented; these are features that must to an extent stand them in good stead even if they are less prolific than some of the other breeds.

In summing up their good qualities, one of the American Poland-China Records says:—

(1) They are the best known machines for manufacturing corn into pork. They thrive better than any other breed upon a diet composed mostly of corn.

(2) They are docile, hardy, reasonably prolific, and almost invariably good mothers.

(3) In large pastures they are not inclined to waste flesh by over-exercise; they have little or no desire to roam far away from home.

(4) The better type Poland-China has as small a proportion of "offal," in comparison with the size of their carcass, as any hog in the hands of the general farmer. Their great feature is their easy and quick-fattening propensities with a tendency to very early maturity.

The recent importations of Poland-Chinas have done much to popularise and improve the type, but we want more of them as they are bound to prove of great value here in introducing their several valuable qualities into our herd. Poland-Chinas are the ideal type for the suburban pig farmer, as they cross well on comparatively common stock; stock that are usually deficient in compactness, early maturity, and food feeding qualities.

Special attention should be paid in selecting pigs of this breed to ensure purity of type. This is more important than with some of the other older established breeds; select long roomy sows that give every evidence of constitutional vigour. Avoid delicate sows, short in body and showing excessive fat, and with drooping quarters and coarse curly hair.

Scale of Points adopted by the several Record Associations in America for the Poland-China breed:—

Colour.—Black, with white points, tip of tail, four white feet, white in face, or on nose, or on point of lower jaw, all to be perceptible without close examination; splashes of white on jaw, legs, flank, or few spots on body not objectionable.

Skin.—Fine and free from wrinkles.

Hair.—Fine, straight, smooth, lying close to and evenly distributed, covering the body well.

Head and Face.—Broad, even and smooth, wide between and above the eyes, slightly dished, tapering evenly and gradually to near the end of nose, broad lower jaw, head moderately short.

Ears.—Neither too large nor too small, but even, fine, thin, leaf shape, slightly inclined forward, standing up slightly at the base to within two-thirds of the tip, where a gentle droop should occur.

Jowl.—Broad, deep, smooth, and firm, carrying fulness back near to point of shoulders, and below the lower jaw, so that lower line will be as low as breast bone when head is carried up level.

Neck.—Wide, deep, short, arched on top from poll to shoulders.

Shoulders.—Broad and oval on top, showing evenness with back and neck, with good width top and bottom, and even smoothness extending well forward.

Back and Loin.—Broad, straight or slightly arched, carrying same width from shoulder to ham, ribs well sprung.

Flank.—Belly broad, straight and full, flank well let down, with straight underline.

Hams.—Broad, full, deep, and long from rump to hock, fleshy, plump, and rounding fulness perceptible everywhere.

Legs and Feet.—Legs medium length, straight heavy bone, well set apart, and squarely under body, wide above knee and hock. *Feet.*—Firm, short, and strong.

Action.—Free, clean, firm, easy, and graceful.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT WARWICK.

1924.	JANUARY.		FEBRUARY.		MARCH.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	5·1	6 49	5·25	6·46	5·46	6·23
2	5·2	6·50	5·26	6·46	5·47	6·22
3	5·3	6 50	5·27	6·45	5·47	6·21
4	5·3	6·50	5·28	6·44	5·48	6 20
5	5·4	6·50	5·29	6·43	5·48	6·19
6	5·5	6 51	5·30	6·43	5·49	6·17
7	5·5	6·51	5·30	6·42	5·49	6·16
8	5·6	6·51	5·31	6·41	5·50	6·15
9	5·6	6·51	5·32	6·40	5·50	6·14
10	5·7	6·51	5·33	6·39	5·51	6·13
11	5·8	6·51	5·33	6·39	5·51	6·12
12	5·9	6·51	5·34	6·38	5·52	6·11
13	5·10	6·51	5·35	6·38	5·53	6·10
14	5·11	6·51	5·36	6·37	5·54	6·9
15	5·12	6·51	5·36	6·36	5·54	6·7
16	5·12	6·51	5·37	6·35	5·55	6·6
17	5·13	6·51	5·38	6·35	5·56	6·5
18	5·14	6·50	5·38	6·34	5·56	6·4
19	5·15	6·50	5·39	6·33	5·57	6·3
20	5·16	6 50	5·40	6·32	5·57	6·2
21	5·16	6·50	5·40	6·32	5·58	6·0
22	5·17	6·50	5·41	6·31	5·58	5·59
23	5·18	6·49	5·41	6·30	5·59	5·58
24	5·19	6·49	5·42	6·29	5·59	5·57
25	5·20	6·49	5·42	6·28	6·0	5·56
26	5·20	6·48	5·43	6·27	6·0	5·55
27	5·21	6·48	5·44	6·26	6·1	5·53
28	5·22	6·47	5 45	6·25	6·1	5·52
29	5·23	6·47	5·45	6·24	6·2	5·51
30	5·24	6·46	...	...	6·2	5·50
31	5·25	6·46	...	...	6·3	5·49

PHASES OF THE MOON, OCCULTATIONS, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania, when "Summer" Time is not used.

6 Jan.	●	New Moon	10 48 p.m.
14 „	☾	First Quarter	8 45 a.m.
22 „	○	Full Moon	10 57 a.m.
29 „	☽	Last Quarter	3 53 p.m.

Perigee 4th Jan., at 8·12 p.m.
Apogee 16th Jan., at 2·42 p.m.

On 1st January, at midday, the earth was 3,000,000 miles nearer to the sun than it will be on 3rd July at 11 p.m. Mercury will be at inferior conjunction with the sun on the 13th at 2 p.m. The moon will pass above the planet Neptune on the 24th at 7 p.m., at an apparent distance of about three times its diameter.

5 Feb.	●	New Moon	11 38 a.m.
13 „	☾	First Quarter	6 9 a.m.
21 „	○	Full Moon	2 7 a.m.
27 „	☽	Last Quarter	11 15 p.m.

Apogee 13th Feb., at 11·42 p.m.
Perigee 26th Feb., at 1·54 a.m.

The planets Venus and Uranus will be apparently remarkably close to one another on 1st February, Venus being the uppermost. On the 5th Mercury will be at its greatest elongation west of the sun at a distance of 25½ degrees. Neptune will be at its highest position about midnight on the 9th. Mars and Jupiter will seem to be remarkably close to one another on the 14th at about 3 a.m. There will be a total eclipse of the moon in the early hours of 21st February, when the moon will enter the earth's umbra or darker shadow a little after midnight. It will be totally eclipsed between about 1·20 a.m. and 2·57 a.m., and will leave the umbra about 4 a.m.

6 Mar.	●	New Moon	1 59 a.m.
14 „	☾	First Quarter	2 50 a.m.
21 „	○	Full Moon	2 30 p.m.
28 „	☽	Last Quarter	6 24 a.m.

Apogee 12th March at 7·54 a.m.
Perigee 24th March at 3·12 a.m.

On 5th March a partial eclipse of the sun will be visible in parts of South America and South Africa, but not in Australia. The planet Uranus will be in conjunction with the sun, which will pass between the earth and Uranus, on the 8th at 6 p.m. Jupiter will be at quadrature with the sun on the 9th at midnight. Being west of the sun, it will be visible from about midnight to dawn.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

[All the particulars on this page were computed for this Journal, and should not be reproduced without acknowledgment.]

CANE PEST COMBAT AND CONTROL.

The Entomologist of the Bureau of Sugar Experiment Stations at Meringa, near Cairns (Mr. E. Jarvis), reports to the Director (Mr. H. T. Easterby) under date 7th February, 1924:—

Weight of Male and Female Greybacks.

In order to determine differences in weight between the sexes of *albohirtum* during development of the ovaries, numbers of these beetles were collected at random from feeding-trees near the Laboratory and carefully weighed. Ten days after emergence (21st December) it required 264 living females or 280 males to weigh 1 lb. av. Thus, during this interval, each female had become nearly half a drachm heavier, or equivalent collectively to the total weight of eighty beetles. It appears, therefore, that a single female prior to full development of the ovaries weighs about 26 grains av., but when containing eggs of a size fit for exclusion weighs at least 38 grains = 2 scruples. Later on in the flighting season, when about 50 per cent. of females had oviposited, those containing fully-grown eggs could at once be separated from the above by this decided difference in weight.

As already pointed out in a previous report (February, 1922), the grey-back cane beetle, although of bulky proportion, is well adapted for migration, being relatively lighter in weight than many smaller and closely related scarabæidæ; while its buoyancy, large size, and big expanse of wing prove decided aids to such aerial transportation.

Distribution of Tachinid Parasites.

Since reporting last October, nineteen additional canegrowers have been supplied with consignments of tachinid flies, sixteen of these being residents of the South Johnstone area, and the remainder of Goondi, Highleigh, and Mount Sophia.

The abovementioned liberations have taken the form of seventeen specially constructed breeding boxes containing in all 128 fly-infested cane sticks taken from our large rearing cages, each stick harbouring from ten to twenty or more pupæ of this tachinid.

As a result of such liberation fully 1,600 flies are expected to issue from these boxes, which, as previously reported, are established in the canefields among stools affected by grubs of the beetle-borer. After escaping through slits left in the cover for this purpose the tachinids fly off the boxes, and finding themselves in the immediate vicinity of their host are able to at once commence the useful work of parasitising the borer grubs. It is encouraging to be able to state that whilst "scouting" for flies at the farm of Mr. B. Salleris at No. 1 Branch, parish of Johnstone, on 18th January, Mr. G. Bates was successful in finding three empty puparia of *Ceromasia sphenophori* in a standing cane-stick, indicating that the parasite has been able to gain a footing and commenced to breed naturally in that locality. Forty flies were liberated at this spot on 1st November, and a box containing seven fly-infested sticks was also established there on 14th December.

Experiments with Para-dichlor.

A number of plots situated in various localities have been injected with para-dichlor. in order to observe its effect on cane-grubs when applied in small doses.

Some of these plots were treated a week or so after emergence of the beetles, to see whether egg-laden females would oviposit in soil contaminated with the odour of this compound.

It is hoped to establish additional plots during the month of February until commencement of the wet season.

Experimentation in this connection has been entrusted to Assistant H. Knust, who obtained considerable experience in this class of field work last season. Half a ton of para-dichlor. has been received this month (January) at Meringa Experiment Station, the sample being of good quality and costing about £2 5s. per cwt.

At this price it would cost about £1 18s. to treat an acre consisting of 6,000 stools with ½ oz. doses injected on each side of the rows of cane.

Poisoning Greyback Cane-beetles.

Experiments have been conducted this season to test the insecticidal value of arsenical dust sprays, which in field practice are more easily and conveniently applied in this form than when mixed with water. Results obtained by the writer during past years have shown that both lead and copper arsenates in solution will kill beetles of *albohirtum*, in from eight to ten days after feeding.

Data derived this season from the application of dry arsenicals indicate that these poisons, when dusted thinly on the leaves of favourite food-plants, will kill the beetles in less than two and a-half days after feeding.

The investigation in question took the form of ten separate experiments in which 299 beetles were used, including 104 control specimens. Ten per cent. of the beetles eating leaves poisoned with lead arsenate died half a day after feeding, while 50 per cent. of those eating Paris green succumbed one day after feeding.

N.U.P.B.A. COMPETITION, ZILLMERE.

There were 2,269 eggs laid in January, an average of 17¼ eggs per bird. One death occurred, Mr. S. Lloyd's No. 63, from bowel trouble. Birds reported broody during the month:—8, 19, 25, 46, 50, 84, 92, 97, 98, 103, 104, 110, 112, 113, 115, 120, 128, 131.

White Leghorns.

Pen No.	Owner.	Jan.	Total.
62	Miss L. M. Dingle	25	u258
14	Enroh Pens	24	u249
72	W. H. Forsyth	19	227
75	W. Shaffrey	20	u227
4	T. H. Craig	25	226
27	H. T. Britten	21	u225
28	H. T. Britten	25	224
50	J. Harrington	16	224
15	W. J. Berry	20	u223
51	Kidd Bros.	24	222
66	R. Duff	21	222
7	Oakleigh P.F.	27	221
13	Enroh Pens	20	220
20	W. Witt	24	220
22	M. F. Newberry	23	218
16	W. J. Berry	22	u217
41	W. Wakefield	23	217
59	G. A. Scaletti	25	217
33	A. S. Walters	22	216
43	Kelvin P.F.	21	215
53	H. Holmes	26	u215
30	W. and G. W. Hindes	22	212
49	J. Harrington	21	212
73	A. Hodge	23	212
71	W. H. Forsyth	24	211
8	Oakleigh P.F.	14	210
10	R. C. J. Turner	25	u207
18	A. W. Ward	14	205
78	W. Smith	24	205
58	H. Fraser	29	u204
69	R. Shaw	21	204
84	L. Andersen	12	204
2	Carinya P.F.	24	203
54	H. Holmes	23	u203
3	T. H. Craig	24	201
42	W. Wakefield	19	201
74	A. Hodge	21	201
37	G. Williams	22	200
38	G. Williams	20	198
61	Miss L. M. Dingle	15	198
70	R. Shaw	21	198
21	M. F. Newberry	26	194
26	E. Stephenson	19	193
48	R. D. Chapman	15	192
55	G. A. Baxter	18	192
83	L. Andersen	24	192
36	J. T. Webster	20	191
40	J. Earl	22	191
34	A. S. Walters	21	u190
64	S. Lloyd	8	190
45	F. R. Koch	17	187
76	W. Shaffrey	17	187
23	Parisian P.Y.	20	186
77	W. Smith	20	186
29	W. and G. W. Hindes	9	184
44	Kelvin P.F.	20	184
81	J. E. G. Purnell	6	184
11	A. Neil	19	182
12	A. Neil	18	u181
1	Carinya P.F.	13	180
52	Kidd Bros.	23	179
47	R. D. Chapman	23	178
6	P. Fallon	18	176
63	S. Lloyd	8	u176
32	H. Needs	23	176
39	J. Earl	22	174
5	P. Fallon	21	173
35	J. T. Webster	13	167
57	H. Fraser	14	166
25	E. Stephenson	14	u160
56	G. A. Baxter	14	160
24	Parisian P.Y.	16	159
31	H. Needs	14	159
79	W. Bliss	22	159
19	W. Witt	9	155
17	A. W. Ward	12	154
85	A. Cowley	6	153
46	F. R. Koch	14	150
9	R. C. J. Turner	25	u146
82	J. E. G. Purnell	15	140
67	J. and G. Green	9	137
68	J. and G. Green	0	115
60	G. A. Scaletti	11	97
65	R. Duff (replaced 6th October, 1923)	23	84
80	W. Bliss	7	64
86	A. Cowley	5	38

Black Orpingtons.

Pen No.	Owner.	Jan.	Total.
92	J. Pryde	14	u235
95	J. Potter	13	233
101	Enroh Pens	21	228
109	T. H. Brotherton	19	223
117	E. C. Raymond	23	220
89	K. Macfarlane	15	207
115	C. C. Dennis	16	u202
110	T. H. Brotherton	19	200
96	J. Potter	24	199
93	H. B. Stephens	29	u197
113	E. Walters	15	197
118	E. C. Raymond	23	197
105	W. Smith	16	187
112	H. M. Chaille	2	187
90	K. Macfarlane	19	185
87	Parisian P.Y.	15	179
91	J. Pryde	21	u179
111	H. M. Chaille	17	179
120	J. Harrington	12	179
106	W. Smith	22	177
88	Parisian P.Y.	14	172
108	E. F. Dennis	15	171

"u" indicates eggs underweight.

N.U.P.B.A. COMPETITION, ZILLMERE—*continued.*

Black Orpingtons—*continued.*

Pen No.	Owner.	Jan.	Total.	Pen No.	Owner.	Jan.	Total.
116	C. C. Dennis	12	166	103	L. Pritchard	12	134
102	Enroh Pens	11	163	114	E. Walters	0	u125
104	L. Pritchard	9	163	97	W. Shaffrey	7	123
98	W. Shaffrey	13	161	107	W. Shaffrey	7	123
99	S. Donovan	19	149	127	E. F. Dennis	0	108
94	H. B. Stephens ..	14	148	100	S. Donovan	8	90
119	J. Harrington ..	0	146				

Other Varieties.

Pen No.	Owner.	Jan.	Total.	Pen No.	Owner.	Jan.	Total.
131	W. H. Forsyth (S.W.)	10	219	123	J. Ferguson (Anc.) ..	10	143
125	J. Ferguson (Lang.) ..	13	201	130	R. A. Girling (Min.) ..	21	138
126	J. Ferguson (Lang.) ..	12	170	129	R. A. Girling (Min.) ..	21	129
128	A. S. Walters (B.R.) ..	9	154	132	W. H. Forsyth (S.W.)	19	u129
127	A. S. Walters (B.R.) ..	20	147	124	J. Ferguson (Anc.) ..	9	124
122	Parisian P.Y. (B.L.) ..	21	145	121	Parisian P.Y. (B.L.) ..	11	u111

"u" indicates eggs underweight.

The Cultivation and Curing of Tobacco.

PIPE and CIGAR.

Profitable Tobacco-growing.

To the question, "Is the growing of heavy export tobaccos profitable, or can Queensland growers compete with other countries in other markets?" the answer is,—Yes, if the farmers are willing to adopt modern methods, and conduct their farming operations upon lines followed by other agricultural communities. Not only that, but they can practically monopolise the market for this class of tobacco in these States, as it is conceded that, so far, this State gives promise of being able to produce the best tobacco grown in Australia. Given the soil and a sufficient rainfall, the cost of production in this State should be less than it is in the United States, for the following reasons:—The Queensland farmer does not require to feed his working stock through a long hard winter, his taxes are little more than half those imposed on the farmer in the United States, and he gets a larger yield than the latter, and I might also add the prices realised here are better than anywhere in the world for the same type of tobacco.

Ordinarily, the amount of tobacco produced here is not commensurate with the labour performed, and for the reason that the labour is often not properly directed.

It is doubtful if any one crop, to the exclusion of all others, can be made profitable one year with another, employing only one-third or one-half of a man's time, and the balance idle or doing wage work when he can get it. By diversifying the crops of the farm, and making tobacco

one of the crops, the farmer does not then depend upon one crop for the whole of his income and sustenance, and he is sure to get a good price for one or more of his products, besides producing his own food, which he can do cheaper than he can buy it out of his tobacco money.

Our manufacturers have shown both liberality and enterprise in their efforts to foster this industry; and it is now up to the farmers to meet this with an effort to produce exactly what the trade demands. There is plenty of suitable land for the production of high-class Pipe Tobacco leaf in the Inglewood and Texas districts, to be had at a moderate price.

Methods.

It goes without saying that the one-crop system requires a higher average of prices to be more profitable than that of several crops.

The cost of production in Queensland can be materially lessened by substituting the plough for the hoe, as I have heretofore suggested —a process which will increase the quantity and improve the quality. Improved curing-sheds and improved methods of curing will also give additional weight to the tobacco, besides improving its quality. The labour of transplanting can be much lessened by a thorough preparation of the ground beforehand, by deep ploughing and deeper cross-ploughing, and thorough harrowing, and getting the soil into the best of tilth. By this means a proper arrangement of soil particles is obtained, and the land is in the best physical condition, influencing beneficially both the temperature and the moisture; the free access of air is secured, supplying the necessary amount of oxygen, and the soil is in such a condition of fineness as to allow a perfect root development.

These are all essential to healthy plant life; and when these conditions exist, the farmer will have fewer plants dying from transplanting, and the labour will be materially lessened. It should be evident to everyone that the soil, in such condition as to supply, fully, all that plant life demands of it, will give the best results in every particular, and this condition cannot be obtained without the free use of the plough.

Comparative Analyses of Tobacco.

The subjoined analyses of Dark Virginia and Queensland Texas raw leaf were made by Mr. J. C. Brünnich, chemist to the Department of Agriculture.

The Queensland tobacco, it will be seen, compares very favourably with the American, and I do not think, to judge by the analyses, that the production of excellent Queensland tobacco presents any difficulties that cannot be overcome. It should be borne in mind that different localities often show a modification of the same product, and the comparatively lower nicotine content, as here shown, does not materially affect the position of the Queensland-grown leaf.

		Valley Soil from Davis County, Kentucky.		Upland So Count
Properties of the Soil—				
Reaction		Neutral.	..	Neutral.
Weight of soil per acre, 6 in. deep	tons	731	..	790
Capacity for water	%	55·2	..	47·6
Absorbed weight per acre, 6 in. deep	tons water	403	..	376
Capillary power, after 6, 12, 24, 36, and 48 hours		9¼, 11¾, 15½, 19, 22 in. high	..	9¾, 12, 15, 22½ in.
Absorptive powers for salts	c.c. nitrogen	70 c.c.	..	..
		Ordinary Elutriat.	Schöne's Elutriat.	Ordinary Elut
Mechanical Analyses of the Soil—				
Stones over 5 mm. diameter	%	Nil.	Diam. of grains.	Nil.
Gravel over 2 mm. diameter	,,		·1–·2 mm. = 15·79%	
Sand (fine)	Fine earth ,,	43·72	·05–·1 = 23·99	37·59
Fine sand (very fine)		30·00	·02–·05 = 29·61	40·06
Clay		15·64	·01–·02 = 7·59	16·84
Organic matter and moisture		10·64	Clay = 12·38	5·51
Vegetable fibres and roots	,,	Traces	= 10·64	Nil.
		Agric. Analyses.	Absol. Analyses.	Agric. Analys
Chemical Analyses of the Soil—				
Moisture	,,	2·572		1·168
Humus (humic acid, &c.)	,,	5·798	10·636	2·980
Other organic matter and combin. water	,,	2·266		1·360
Chlorine	Cl ,,	·008	·008	·005
Carbonic acid	CO_2 ,,	·322	·322	·108
Total nitrogen	N ,,	2·46	..	
Soluble in HCl of 1·1 sp. gr.—				
Sol. silica	SiO_2 ,,	·016	Diff. 69·496	·015
Sulphuric acid	SO_3 ,,	·061	·061	·039
Phosphoric acid	P_2O_5 ,,	·172	·176	·067
Iron	Fe_2O_3 ,,	3·598	14·664	2·560
Alumina	Al_2O_3 ,,	3·230		2·283
Lime	CaO ,,	·605	1·442	·185
Magnesia	MgO ,,	·261	·565	·243
Potash	K_2O ,,	·260	1·250	·152
Soda	Na_2O ,,	·263	1·380	·243
Insoluble in HCl of 1·1 sp. gr.	,,	*80·779	..	*88·681
Total	,,	100·211	100·000	100·089

* Insoluble matter contains clay = 15·26 .. clay = 9·47

Remarks :—Special care was taken in these analyses, and not only the ordinary agricultural an with the aid of hydrofluoric acid, were made. The clay, also, was determined by chemical methods in the clay found by both methods agreeing fairly well.

The analyses show that our Queensland tobacco soil resembles the samples of American tobacco quite so porous, with regard to capillarity for water, as the American soils.

The absorptive powers for salts are in all soils rather low, as compared with some of our fertile l a loss of manure may easily take place.

OF SOILS.

Soils.				Queensland Tobacco Soil.	
lleyland Soil from Henderson County, Kentucky.		Valleyland Subsoil, Henderson County, Kentucky.		From Texas District.	
Neutral.	..	Neutral.	..	Neutral.	..
805	..	774	..	806	..
52·4	..	54·0	..	56·4	..
422	..	418	..	454	..
0¾, 14¼, 19, 22 in.	..	8¾, 11¼, 15, 18¼, 21¼ in.	..	6½, 10, 12½, 15½, 17¾ in.	..
62 c.c.	..	64 c.c.	..	66 c.c.	..
ary Elutriat.	Schöne's Elutriat.	Ordinary Elutriat.	Schöne's Elutriat.	Ordinary Elutriat.	Schöne's Elutriat.
Nil.	·1-·2 mm. = 11·81	..	10·25	..	29·28
	·05-·1 = 17·77	Nil.	21·88	Nil.	7·58
34·81	·02-·05 = 36·99	34·57	33·15	37·25	19·58
38·06	·01-·02 = 7·97	38·19	9·91	30·54	12·23
19·76	Clay = 18·09	19·34	16·91	24·97	24·09
7·37	= 7·37	7·90	7·90	7·24	7·24
Traces	..	Nil.	..	Traces	..
ic. Analyses.	Absol. Analyses.	Agric. Analyses.	Absol. Analyses.	Agric. Analyses.	Absol. Analyses
1·970	7·372	2·092	7·094	2·288	7·244
3·765		3·490		3·346	
1·637		2·322		1·610	
·007	·007	·006	·006	·009	·009
·195	·195	·220	·220	·120	·126
·202	..	·110	..	·179	..
·041	75·707	·009	74·308	·182	71·191
·041	·041	·025	·025	·117	·117
·115	·115	·110	·114	·139	·146
2·881	12·975	2·719	13·066	2·723	4·048
3·084		2·821		5·168	12·866
·265	1·122	·315	1·320	·515	1·646
·421	·743	·413	·886	·502	·840
·213	·971	·190	1·280	·489	1·275
·192	·752	·180	·871	·162	·498
85·344	..	*85·130	..	*83·374	..
00·171	100·000	100·042	100·000	100·744	100·000
12·07	..	clay = 13·04	..	clay = 16·78	

oiling hydrochloric acid of 1·1 sp. gr., but also absolute analyses, by making the whole soils soluble HCl. The elutriations of these very finely textured soils were also made by two different methods,

Queensland soil contains a little more of the coarsest sand, and also a little more clay ; it is also not

which reach an absorption coefficient from 200 to 300 ; it means that if the soils are heavily manured

COMPARATIVE ANALYSES OF TOBACCOS.

	Dark Virginia Raw Leaf. Per Cent.	Queensland Texas Raw Leaf. Per Cent.
Moisture	9·44	10·48
Nicotin	4·52	2·54
Ammonia	·53	·07
Nitric acid	·83	1·05
Malic acid	12·05	10·72
Citric acid	2·81	4·55
Oxalic acid	3·18	3·64
Acetic acid	·55	·79
Tannic acid	1·80	1·50
Pectic acid	7·18	9·55
Pectose bodies and gums	3·61	4·55
Albuminoids	11·92	12·20
Other insolvent organic matters (diff.)	6·87	10·35
Cellulose	10·22	7·95
Oils, fats, chlorophyll	5·90	4·16
Resins	4·51	2·87
Starch	·64	·58
Total pure ash	13·64	12·45
Ash containing—		
Silica and sand	3·78	1·60
Phosphoric acid	·38	·56
Sulphuric acid	·56	·47
Chlorine	·74	·52
Lime	3·94	3·59
Magnesia	1·04	·91
Iron and alumina	·46	·44
Potash	2·60	3·79
Soda	·13	·57
The tobaccos contained—		
Total nitrogen	2·753	2·410
Amido nitrogen	·616	·812

Analyses of Tobacco Soils.

American and Queensland Soils Compared.

In order to give those who may contemplate tobacco-growing an idea of the character of the soil likely to produce the best quality of tobacco, I herewith submit an analysis made by Mr. Brünnich, together with his footnote, of some of the best American tobacco soils and of the soil of Texas (Queensland). It will be borne in mind that these soils grow only the heavy or export types of tobacco. This analysis shows a great similarity in all of these soils, and, I may state, corresponds very closely to the analysis made by the United States Department of Agriculture as to their physical properties.

These soils are all in limestone country, which is nearly always the case where our best heavy tobaccos grow. It may be well to state that very heavy soils, producing rank growth, never produce good tobacco. All tobacco land should be well drained. It may be well for

the further information of intending growers to quote from the United States Bulletin No. 11, Division of Soils, that they may understand that all does not depend upon soil:—

Experience the only Safe Test of Climate for Tobacco.

One must still judge, so far as the climate is concerned, mainly from the experience of others as to the class of tobacco to be raised, as the ordinary meteorological record will be of very little value in determining this point. The plant is far more sensitive to these meteorological conditions than are our instruments. Even in such a famous tobacco region as Cuba, tobacco of good quality cannot be grown in the immediate vicinity of the ocean or in certain parts of the island, even on what would otherwise be considered good tobacco lands. This has been the experience also in Sumatra and in our own country, but the influences are too subtle to be detected by our meteorological instruments.

Little, therefore, can be said at the present time in regard to the suitable climatic condition for tobacco of any particular type or quality. But a humid climate is necessary during growing season.

Soils of the Tobacco Districts.

Under given climatic conditions the class and type of tobacco depend upon the character of the soil, especially on the physical character of the soil upon which it is grown, while the grade is dependent largely upon the cultivation and curing of the crop.

Making Seed Beds.

Seed beds should be sown, and the plants transplanted to the field, just as is done with cabbage. After clearing the soil of any timber growth and before stirring the soil, wood, bark, and leaves should be placed on the land and set fire to. The ground should be burned sufficiently to destroy all weed seeds, grass roots, &c. The reasons for this are several. It destroys weeds and grass, and no weeding of the beds will be necessary, and this saves much time and labour; the ashes serve as a good fertiliser, and the small bits of charcoal greatly conserve the warmth of the bed. After the ground has cooled, rake off any *débris* that may be left unburnt, but leave the ashes on. Dig the bed well to the depth of 6 or 7 inches, taking care to reverse the soil; work and rake it until you have made it as fine as possible.

Virgin soil is the best for seed beds, and should not be on low-lying, wet, or foggy flats; the land should be convenient to water, that the plants may be watered when needed. If the beds are made on low, damp, or foggy flats they will be more liable to disease.

Sowing Seed Beds.

The quantity of seed to be sown is about a teaspoonful to a bed 5 by 20 feet or 100 square feet. The day before sowing put the seeds into a glass of water, and let them stand for two or three hours. By that time, all the seeds of strong vitality will have settled to the bottom of the glass; those left floating on top are either sterile or of such low vitality as to produce only weakling plants. Pour off the water and take only the seeds left in the bottom of the glass. Dry them in the sun or near the fire; then mix them with ashes or lime thoroughly, and sow evenly over the bed. In drying seeds after taking from the water only a few minutes are necessary to get the dampness off them that they may not stick together when mixing with the ashes or lime. *After sowing the seed, do not rake or tramp it in, but take a sprinkler and sprinkle water well, carefully, and evenly over the bed, not allowing the water to run in little streams on the surface, as this disturbs the position of the seed and makes the plants thick and thin in the bed. As the water soaks in, go over the bed again and again, until it is well watered. This will give a sufficient covering of earth to the seed.*

Do not wait for rainy or seasonable weather for sowing your beds, but sow in time to have plants ready for transplanting when the seasonable weather begins.

This you can do by watering your beds regularly as described under the section "Treatment of Seed Beds."

Do not sow all your beds at one time, but sow one or two beds every week or ten days, so that you will have plants coming on at different times, which gives you more time for getting out your crop. Sow plenty of beds, so as to have plenty of plants. Be careful to sow evenly over the bed.

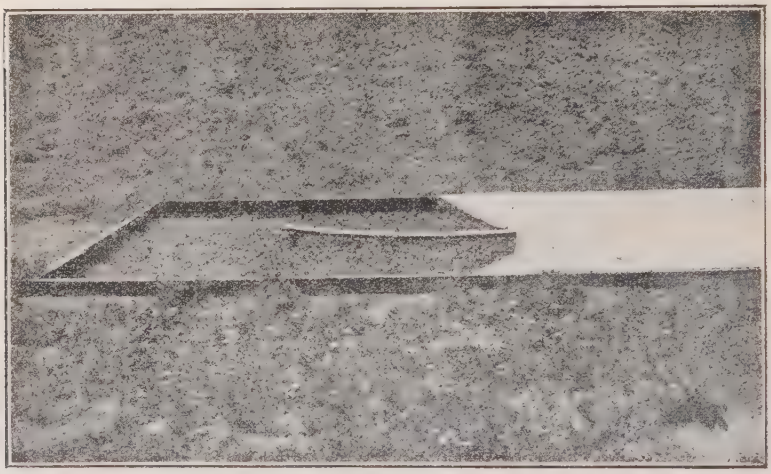
Treatment of Seed Beds.

After sowing, the beds should be covered. Butter cloth or calico is best; but, in the absence of these, grass can be used. *This covering is necessary, as the hot sun will kill the plants as they sprout, or "in the crook,"* as the Yankees say.

As the plants begin to grow, they should be gradually hardened by removing the covering each day for awhile, making the time longer each day until they are left entirely uncovered for a week before transplanting. *If the weather is dry, the beds should be watered at least every other day, late in the afternoon, until the plants come up, which may be a week or it may be two weeks, owing to the season.*

If the sun is very hot, a good covering of grass laid flat on the ground is the better plan until the plants are up; and, as they begin to grow, this covering should be thinned, but the grass covering need not be removed when the plants are watered.

After the plants are well up, water as they need it, but not too much or they will grow up thin and sappy, and will not stand transplanting so well. Before sowing the seed, it is a good plan to sow about ½ of an inch of sand over the bed. This prevents the ground cementing so badly when the plants are being watered. When they have developed four to six leaves, care should be taken not to water too much, or "blue mould" may develop on the plants. They should only have enough water to keep them healthy. A slow-growing plant in the bed, if healthy, is usually hardy. Thin out the plants if they are too thick in the bed; also pull up any weeds that may appear in the beds, but if the beds are well burned you will not be troubled with them.



SEED BED AND COVERING.

Insect Pests.

Stem Grubs in Tobacco.

Some experiments made in destroying the stem grub in the plant beds by Mr. Charles Toon, of Toon and Kiss, tobacco-growers on Eurie Creek, Bowen, will be of interest to tobacco-growers generally, and should further trials show it to be effective, it will certainly be a great saving to the growers throughout Australia. Mr. Toon says he was able to keep his seed beds entirely free of the stem grub by spraying with the arsenate of lead—two teaspoonfuls of the lead to 1 gallon of water. The first spraying was given when the plants showed three or four leaves; he sprayed again four days later, and there were no stem grubs in the beds so treated, while the beds not treated were badly infested, as were those of his neighbours. On examination of the treated plants he says he found dead grubs just entering the stem of the plant, and also dead ones that had effected an entrance, but in no instance did he find any alive, and

all had died before doing any injury to the plant. Mr. Toon is quite convinced the remedy is effective, and it is to be hoped other growers will find it so.

The following remedy (taken from "The Western Tobacco Journal") might be tried on beds to prevent the stem grub, as it is simple and cheap:—"A new and what is believed to be an effective preventive method to circumvent the ravages of the troublesome cut worm has been discovered by an Orfordville (Wis.) tobacco-grower, which is so inexpensive and simple that it ought to commend itself to very general use. Here it is: Add to each barrel of water used in the transplanting about 5 oz. of ordinary carbide, such as is used in the making of gas for lighting plants, autos, &c., making the water so offensive that it is alleged that worms will not go near the plants. The remedy works so well that the discovery has been given the State Experiment Station for further trial, and it is believed that bulletins will be issued commending it to general use. The grower who first made use of this mixture says it is a sure cure. At any event, it is worth a trial. If all that is claimed for it is true, the discovery may become a great help to the tobacco-growers of the entire country."

Diseases in Tobacco.

The only disease that is troublesome in Australia is Blue Mould, that mostly attacks the plants in the seed beds, though sometimes it manifests itself in the field. No sure remedy for it is known, but when it is present in the country as little watering of beds as is possible for the plants to live should be done. About ½ inch of pure sand, placed on top of the beds before sowing, will tend to conserve the warmth of the bed, thus minimising the danger of this disease, and also prevent the beds from caking when watering.

Improving the Tobacco Plant.

A series of interesting experiments has been carried out by Dr. Trobut, of Algeria, that prove tobacco may be improved by proper cultivation and selection, and are given in "The Western Tobacco Journal," and herewith reproduced. It is a most valuable contribution to the tobacco industry, and should be carefully read and studied by every grower in Queensland.

These experiments have been made on common-sense lines, and are such as can be duplicated by the ordinary farmer. I would especially call the attention of intending growers to the manner in which he selects his seed and his seed plants, and if they are carefully followed will result in stronger and healthier plants, superior quality, and prevent the rapid deterioration of the plant, so common in Australia.

The "Western Tobacco Journal" says:—

"The recent experiments conducted by Dr. Trobut, upon the selection and improvement of tobacco by means of seed selections, furnish valuable evidence for the guidance of growers of tobacco in all tobacco sections. He says that planters may rapidly ameliorate the race of tobacco they cultivate by using carefully selected seed. This choice, however, involves some precautions. *The plants should be selected with the greatest care for seed purposes, and at the time of flowering covered around the inflorescence with light closely-woven cloth. By this operation one avoids the pollination of selected plants by pollen of inferior plants.* It is also of advantage to carry on artificial pollination of the flowers on the selected stalks by carrying pollen from one to another. This operation is, to be sure, limited and somewhat uncertain, but it permits one, nevertheless, to obtain very vigorous plants of decided merit in many instances.

"The experiments carried on by Dr. Trobut at the botanical station in Algeria during four years, on the value of tobacco crosses, are an illustration of the usefulness of the practice. The object of those experiments was to unite all of the races of tobacco already acclimated in Algeria and a collection of exotic tobaccos. From the crosses of the introduced tobaccos with the best races already acclimated, there have resulted a certain number of varieties which seem advantageous for these regions. In the crosses carried on for the purpose of improving the native tobaccos, he observed that the seeds of tobacco are often badly formed and show low specific gravity. By placing the tobacco seed in water, it was observed that only one-half of the seed sunk to the bottom of the vessel. The seeds which floated on the surface of the water were nevertheless able to germinate, but gave less vigorous plants during their whole development.

"By sowing the seed which floated and those which sank, he established the fact that all of the plants grown from the heavy seed were greener, taller, and more vigorous than the plants raised from the light seed. The seedlings transplanted in the same field, alternating a plant from heavy seed with a plant from light seed, preserved their characters, the plants from the heavy seed having the more desirable leaves and producing the best plants. The plants from the light seed developed more slowly, and had a tendency to bloom before having reached sufficient development. *The weight of leaves from the plants grown from the light seed was hardly one-half that of the leaves harvested from the plants grown from the heavy seed.*

"There is no doubt that considerable advantage is to be derived from this easy selection of the heavy seed. Growers of tobacco always have an excessive amount of seed. Before sprouting or sowing this seed, they should throw it into a vessel of water, shake gently, and take out the seed

that float, destroying it so that it can not be used for planting through any possible mistake. The amount of seed that float usually represents about one-half of the seed gathered. The heavy seed may be dried and preserved, or the best plan is to make the separation just before time for sowing, and then sow immediately after this treatment. The heavy seed thus planted will give more vigorous plants, producing better leaves, but with a tendency to bloom a little later than plants grown from the light seed.

"In practice it may be found that few, if any, of the seeds sink immediately after having been thrown into the water. It seems that it is necessary for the seeds to stand for some time in the water, during which they become thoroughly moistened and will then sink. By careful examination, the moment when all of the heavy seed have sunk can be determined, and the light seed removed. Another plan for the separation of the light from the heavy seed is by the uses of sieves having such sized openings that the heavy seed will fall through and the light seed be retained and finally discarded. Cheese cloth having the proper size of mesh can be used successfully for this purpose. If it is possible to use an air blast, there is probably no better method of separation. As the tobacco seeds are very light it will be found necessary to have a very steady current of air, and of such volume that the heavy seed will fall and the light seed be carried away.

Selection of Young Plants in the Seed Bed.

"One of the important results of the work of Dr. Trobut has been his study of the effect of selection of young plants in the seed bed upon their yield and quality of the mature plants. He found that by an examination of the young plants in the seed bed it was possible to tell from the variation among the young plants the individuals which were most desirable for use and should be reserved for planting. He selected those young plants in which the side veins are at regular right angles to the midribs of the leaves. The plants having irregular veins, or other undesirable characteristics of leaves, were discarded, as he found that such plants did not develop good plants in the field. He concludes that it is perfectly practicable for the grower to study the young plants in the seed bed, and from this examination weed out the unprofitable type of plants. This point can well be taken into consideration by every grower, and by following these injunctions secure the best plants for growing in the field.

"The greatest value of these experiments is the emphasis laid upon the value of good seed. There is no more important factor in the production of the crop, and up to this time little attention has been paid to its real importance. A good crop cannot be produced from poor seed, no matter how much labour and expense is given to the growing of the crop. On the other hand, careful seed selection and the securing of

improved types and races of tobacco by hybridisation mean increased profits with little or no extra expenditure on the part of the grower. In view of the large acreage which a small amount of seed will plant, it seems that there is no crop in which practical results can be obtained so sure and with such widespread beneficial results as in the case of tobacco. Heretofore, growers have allowed the matter to work out for itself, making no direct effort to produce desired types, races, or uniformity of quantity and quality of tobacco, but the time has come, as in the case of other crops, when it is possible to decide upon the type desired, and by following the laws of selection and crossing produce the desired kind of tobacco."

Cultivation of Tobacco.

In selecting land to be planted in tobacco, as nearly as possible it should be free from weeds and grass surrounding it, as such places serve as breeding-grounds and hiding-places for pests that may give great trouble to the farmer; it is best to have the tobacco-field between other cultivated fields, such as corn and wheat, but not near potatoes. The ground should be well and deeply ploughed during the winter, in order to destroy the insect larvæ as much as possible, and to well rot the rubbish that may be turned under; and by means of a spring-tooth harrow or a cultivator it should be kept clean until the time for planting arrives. Before transplanting, the ground should again be deeply and well ploughed, not cutting too wide a furrow—by cutting only about two-thirds of the capacity of the plough, you pulverise better; the ploughing should be fully 8 or 10 inches deep; then double harrowed, to get the ground as finely pulverised as possible.

The importance of the thorough preparation of the soil for tobacco, and the thorough cultivation of the crop in the field, cannot be too strongly impressed upon the grower. Tobacco is a profitable and valuable crop, and it should be the aim of every grower to use every means available to get the best results, which mean always a market and the best prices.

That the crop will grow and thrive in badly prepared ground, under favourable weather conditions, is true, but where the soil is thoroughly worked down and pulverised the quality of the product is much improved, as there seems to be something required by the plant, that is supplied by the soil, that is not to be obtained in sufficient quantities in coarse and badly prepared land. This has not only been demonstrated by experiments, but is further shown by the known fact that the best tobacco lands of all countries are those capable of the finest tilth. In this country, where seasonable rains do not always come at the desired time, the crop set in the well-prepared soil will be found to suffer least from the

droughty conditions that may prevail at a critical time, for the reason it will retain the moisture better than the soil that has not been well prepared.

In other words, the ground should be in the best condition possible. New ground does not require so deep ploughing as old; it also gives a lighter yield and better colour. All the land intended for tobacco should be put in condition, that the farmer may be able to transplant whenever he has the opportunity.

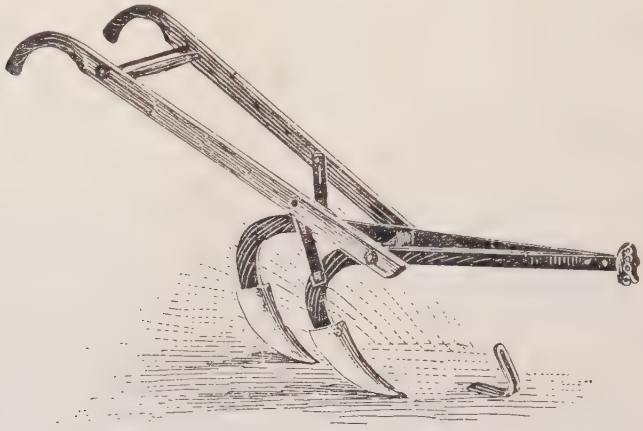
The land should be laid off 3½ feet one way, if the soil be light 3½ feet each way, but if the soil be heavy it is best to plant closer—say, 3½ feet by 2 feet. If planted too far apart in heavy soils it will grow too coarse and rank. If checked 3½ feet each way it can be cultivated both ways, but if planted, say, 24 to 30 inches in the row it can be cultivated only one way. It is best to transplant in showery and cloudy weather if possible, as then the plants will not need to be watered or covered; if such weather cannot be had, then it is best to do it late in the afternoon, beginning when the sun is about an hour high, watering the plants as you set them, and covering early the next morning; this covering need not remain more than five or six days. If your plant bed is very dry and hard, water it sufficiently to make the earth soft before drawing the plants from the bed, and it is best to leave all the dirt possible sticking to the roots; the roots should not be pinched or in any way mutilated. The plants should not be washed before setting, for they are now free of disease or insects. In transplanting, use a peg, made from a piece of broom-handle, sharpened at one end; this should be thrust into the ground deep enough to take the whole root of the plant; insert the root, and press the dirt well around it; do not press it about the stem, but let the dirt be thrown loosely about it. The plant should be well and firmly set in the ground, and this can be determined by taking hold of the tip of the leaf and pulling gently, and if the plant is properly set the leaf will break without the plant pulling out. When properly set, they will take root in about ten days; and as soon as this has taken place and the plant begins growing, go over the field with a hoe, chopping the weeds from the field and loosening the earth about the plant, and after this a man with a hoe is not worth his tucker in the tobacco patch, but do the cultivating with the plough.

The object of cultivation is to keep the soil in condition for supplying all of the plants' requirements, and not solely to kill the weeds.

No plant responds more quickly to thorough cultivation than tobacco, and probably none are more improved by it in character and quality.

The field should be kept clean and in good tilth, to promote a rapid and healthful growth. This cultivation creates a dust mulch that

conserves the moisture in the soil; it allows the air to penetrate it, releases any harmful gases that may have accumulated there, keeps down weeds, and destroys the hiding places of insects. This cultivation should be frequent, and commence after the first hoeing, and continue at least every ten days, until the tobacco is too large for the horse to pass between the rows without injury to the plant.



DOUBLE SHOVEL PLOUGH.

For this work a short swingle-tree should be used. The first cultivation should be deep and close to the plants before many roots have been formed, and for this a double shovel plough is the best, breaking the middle well out. This leaves the ground in good condition for the roots to spread, and gives the plant the full benefit of an ample feeding surface and no dwarfed roots.

After this, frequent and shallow cultivation is desirable with the Planet Junior for working the soil gradually towards the plant. By this gradual working the soil towards the plant, you do not create a large evaporating surface before the ground is well shaded by the plant. This is essential in this State, where the hot sun and winds cause rapid evaporation.

A cloddy soil will certainly defeat all efforts to get a good and uniform stand in the field, and care should be taken to plough the ground when it is in proper condition. A tobacco-field should be ploughed after each hard rain—after the ground has sufficiently dried, until the plant is too large. When the plants are kept in a perfectly healthy and vigorous conditions, they are less susceptible to disease. Priming, or taking off the bottom leaves in order to allow ventilation under the plant, is also a condition to healthy fields. The amount of water in the soil to produce the best results for heavy pipe tobaccos is estimated to be from 15 to 20 per cent.

"Below 15 per cent. the line of drought is reached, and the methods of cultivation should have for their prime object the maintenance of the water supply above the line of drought, so that the growth of the plant shall receive no check."—*Whitney.*

It is important that growers should take notice of these things, for when they seek an outlet for the surplus product they must offer an article quite as good as others, and one which is produced as cheaply. This cannot be done unless the best methods are adopted—the best are the most economical.

The appreciation of the necessity of proper methods, and their adoption, will save fully 25 per cent. of labour, besides giving better and increased results.

The various pests of the tobacco plant can be controlled by the use of Paris green as a spray, but this must not be used after the tobacco has been topped. It is very effective in the case of the Miner.

The lands best suited to growing heavy export or pipe tobaccos are friable and well drained. Limestone soils, with a small percentage of clay and a large percentage of silt, are the best. Wet or forcing soils will not grow good tobacco, as the product will be rank and woody.

Tobacco should be topped and primed as soon as the proper number of leaves can be secured; do not wait for the bloom. You retard the development of the top leaves in waiting too long, and the plant ripens at the bottom before the top is done growing.

Priming—that is, bottom leaves taken off—leaves you less work to do, and gives the remaining leaves the full benefit of plant life. All the leaves that are damaged should be taken off; and if none or only a few are damaged, take four to six leaves, that the remaining ones may be well off the ground, then pinch out the top, leaving not more than fourteen leaves, though most good growers prefer twelve leaves. All the plants will not be ready for topping at once, and a second topping will be necessary, when every plant should be topped if it should have only six or eight leaves. Suckers must not be allowed to grow, but taken off as soon as they appear; for if allowed to grow they seriously damage the tobacco. The above is necessary in order to have the field ripen evenly, and this again is necessary to get a good cure.

In all the work done in getting out the crop and subsequent work, the idea should be to have a field of even growth, that all may be harvested at once. An important matter for the farmer to remember is not to overcrop himself, and to know that 2 acres of tobacco properly looked after will yield as many pounds and more shillings than 4 acres that have to be neglected and that a plant topped at twelve or fourteen leaves will weigh as much as one of twenty leaves, and not so many leaves to sucker and to look after. More pounds and a better product,

more shillings and less labour, will be the result if these instructions, taken with those given in the articles on plant beds and curing, are faithfully followed.

Directions for Cutting and Curing Pipe Tobaccos.

(*See* Editorial note *re* Flue Curing.)

In cutting tobacco, if the day be cloudy, you may cut at any time; but if the sun be shining and hot, cut only late in the afternoon. Never cut or handle tobacco when it is wet, either from dew or rain. Never cut in the afternoon more than you can take up the following morning before the sun gets hot. Never cut after a hard rain, as it washes the gum off the tobacco, but wait a few days for it to gather gum again.

The tobacco cut in the afternoon may be carefully and gently laid in piles of ten or twelve plants for convenience in hanging, unless you prefer to hang as you cut.

There are several ways of harvesting the crop: 1st, by gathering the leaves as they ripen and stringing the leaves on strings or wires back to back. This method is slow and expensive, but saves barn room; 2nd, by cutting down the stalk, have all sticks made to a gauge, and a spear made to fit the end, and pierce the plant as the butt end, and push back over the stick until it is full, then remove spear and put on another stick; 3rd, this is by splitting the stalk, as in the illustration, until within a few inches of the ground. and then slightly bend the stalk over, and with a sharp stroke cut it off just below the split, so you may hang the plant astride the stick.

Shewing how to place tobacco on Stick.

The most convenient and economical way to hang it on the stick is to sharpen the stick at one end; and, when you want to put the tobacco on it, thrust it into the ground at an angle of about 45 degrees, and then place the plants astride it.

In hanging tobacco on the stick, *it should not be put closer than four to six inches apart*, according to size of plant. If put closer than this, you will have pole burn, and many leaves that will not cure, but dry up, dead, dingy, and green. After putting the tobacco on the sticks, put it on scaffolds in the open air, and if it is thoroughly wilted—that is, leaf and stem have become perfectly limber—put it close together. It is best for it not to get rained on while on the scaffold. If this should happen, however, open it out until it dries off; then close it up again.

— Cutting Tobacco —

If possible, the scaffold should be placed where it will be shaded from 11 till 2 o'clock.

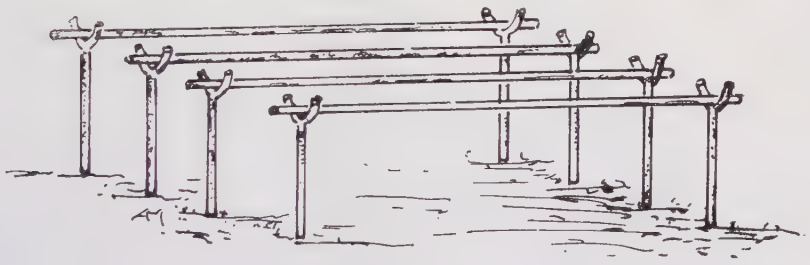
Let the tobacco hang on the scaffold from one to two weeks, if the weather is not showery or rainy, until it yellows; then remove to the barn and hang it close together, owing to size of plants, and regulate plants on sticks. Bear in mind—do not hang close on the sticks, but you can crowd somewhat on scaffold or in shed, because when the tobacco begins to dry it will leave space between the sticks for ventilation.

Now begins the most particular part of the whole process of making tobacco, for it is now that you must fix in the leaf all the desirable qualities that go to make a valuable product: strength, elasticity of leaf, flavour, &c. If you wish to air-cure, your barns should be so constructed that they can be made very close or very open as may be required by weather conditions.

If you desire to fire-cure, you want your barns closed in with plenty of ventilation around the eaves and in the gable-ends, and at the bottom of the sides ventilation that can be closed or opened as desired, that you may be able to control and regulate it.

If you desire to cure your leaf a bright colour, artificial heat is necessary, letting the tobacco stay on the scaffold and yellow, then fixing this colour with fire.

To cure with open fires, build small fires in pits over the floor of the barn, of slow burning wood, and keep them low and smothered, and keep a low temperature for the first twenty-four hours, not above 90 degrees, for a hot fire at the start will blue your tobacco. After the first twenty-four hours, if the tobacco has yellowed, raise your heat *very* gradually until by the end of forty-eight hours from the time of starting you may have it from 125 degrees to 135 degrees. After that, you may safely go to 160 degrees or 170 degrees. Keep careful watch of fire night and day, until the leaf and above half or two-thirds of the midrib or stem are cured, and then draw your fires, and allow the barn to cool. In a few days (from the sap left in the stalk and stem) you will find your tobacco has become soft, and the colours that were irregular before have run into each other, and formed a solid colour over the leaf. When this has taken place, then again build your fires, and continue them until the stem and stalk are entirely cured, when you will not need to fire more, unless there should be a continued rainy spell and your tobacco gets very soft, when a little fire to dry out the barn will do good.



—Scaffold—

If you prefer to air-cure your tobacco, then, as before stated, your barn should be so constructed as to be very close or very open, as the season may require, and always with plenty of ventilation at top, that hot air may get out of the roof.

After scaffolding, hang in your barn as heretofore directed. In cool, pleasant weather, and at night, keep your barn open to the fullest. In very hot weather, especially when winds are blowing, or in foggy weather, keep your barn closed.

If the weather be showery, with intervals of sunshine, you may keep them open; but if the weather be continuously wet and muggy, close them; and if you find your tobacco getting very soft, with a tendency to mould, build a little fire to dry out the barn.

The idea in curing by air is to keep the tobacco curing uniformly all the time, neither too fast nor too slow; and the opening and closing the barn must be regulated with that idea.

In curing tobacco with fire, the tips of the tobacco leaves should never be nearer the fire than 5 feet.

Tobacco is ripe when it grains up, and shows brown spots on the leaf, and shows a rough surface, and is very brittle, breaking readily when doubled up.

It should never be allowed to stand until the points of the leaf begin to dry up, for then it is beginning to lose weight, and is too far gone to make a good cure.

At all times be careful not to get your tobacco dirty, for dirty tobacco has no value.

Be careful in handling not to bruise the leaves, for bruised tobacco will not cure properly. Good tobacco can only be made by good curing, and good curing can come only by painstaking and experience and close observation. It is a profitable crop if well done, and, like all other things, if you do not try to do it well, had as well be left alone.

Handling Heavy Pipe Tobaccos.

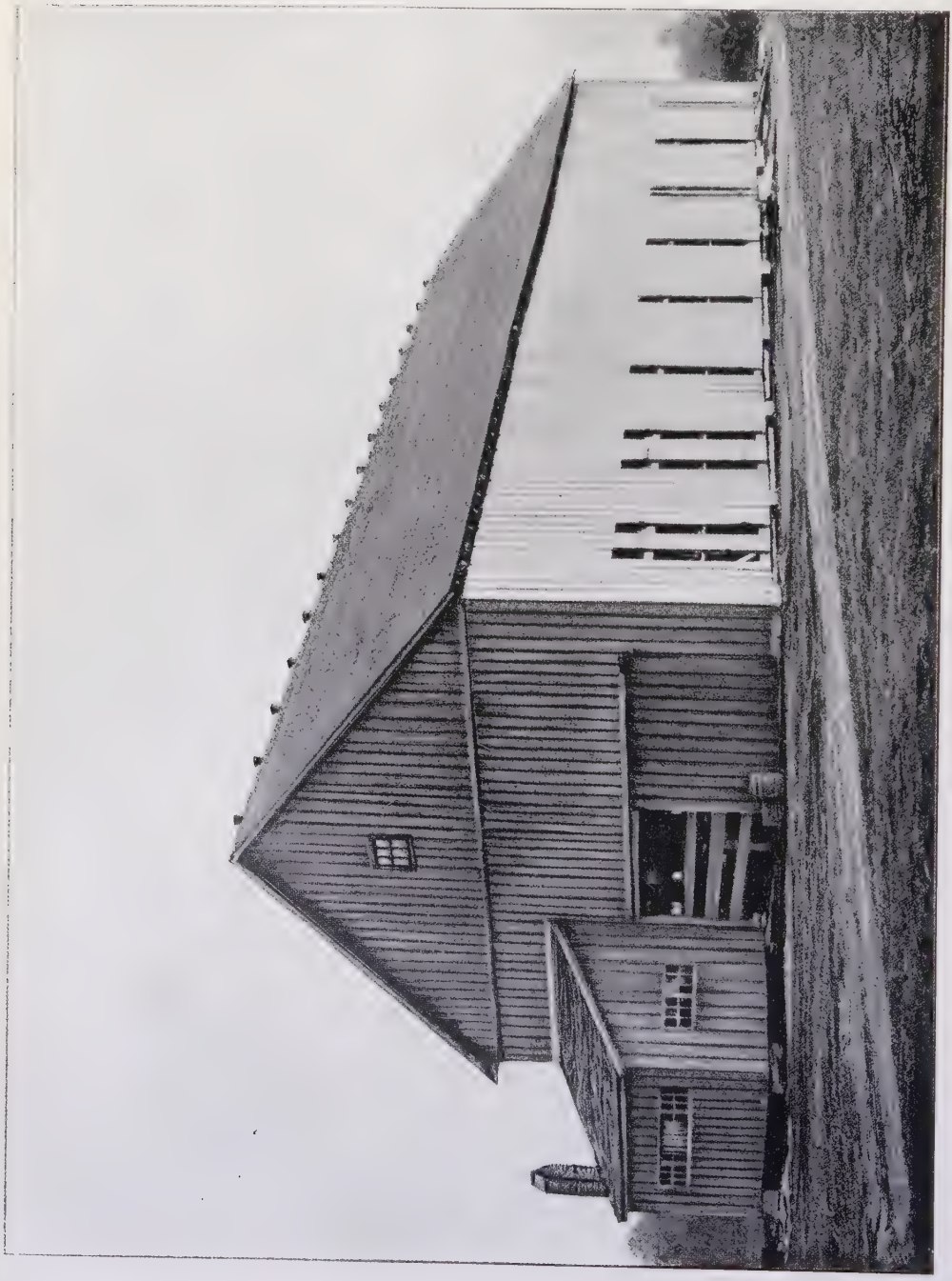
Many farmers seem to think that the period of careful management is over when the harvest time has come, when really it is the time for greatest care and intelligent work. Open sheds are not the best; the tobacco is thus exposed to all sorts of weather, and conditions cannot be controlled; it cures unevenly and irregularly, producing many sorts in the one shed. Tobacco has not finished its cure as soon as dried out; it still retains objectionable matter that must be either modified or eliminated altogether, and this is accomplished by continued hanging.

Heavy tobaccos put into the bulk as soon as dried do not have the aroma that is in those that have been hung for two or three months longer. It may be stripped and put into hands, but should be re-hung to finish the cure; in fact, it is preferred that it should be stripped soon after it has dried.

In stripping, the green or greenish should be put in hands to itself, and they should be small, not more than twelve or fourteen leaves each, and hung where light and air can get to it; if the hands are large, the leaves in the centre will not bleach out, but remain green. It is best to tie all of the tobacco in small hands, as it will continue the cure more uniformly, can be ordered more regularly, and handled more neatly.

Assorting should be carefully done, that the tobacco may have a uniform appearance, care being taken to put nothing with the best grade, or No. 1, that does not belong there; carelessness in this often causes a low figure to be paid for it, and *sometimes gives trouble with the purchaser, when he has to reassort it.* Every hand should be tied with a leaf of the same colour as the tobacco in that hand, not necessarily a good leaf, but the hand should be and look uniform. Please the eye and you please the purchaser, and the grower that establishes a reputation for neat and proper handling of his crop always gets top prices, for all the buyers want his tobacco, as it gives them no trouble.

Before bulking, it should be thoroughly dried out in the heads, and bulked as it comes into condition, and not when it is drying out, for then the stem may be surcharged with moisture that will be taken up by the leaf, and the whole get too soft and funk.



OPEN FIRE AND AIR CURING-SHED, MODERN STYLE.

The proper condition for bulking is when it is just pliable and the midrib or stem will snap halfway down the leaf. The proper condition can be determined by taking the tails in the hand and squeezing them together; if they fall apart slowly after removing the pressure, it is right for bulking, but if they stick together it is too soft, and had better be left hanging.

In bulking, the floor should be well off the ground, and so arranged that the dampness arising from the ground cannot penetrate through to the tobacco. The bulks should be large, not less than 8 or 10 feet wide, and as long as may be convenient; this allows the tobacco to sweat uniformly and continuously, not being disturbed by weather conditions; whereas narrow bulks sweat fitfully, some days lightly, and on other days not at all, owing to the state of the weather. This is important, as tobacco that does not sweat properly does not develop desirable qualities. The bulk should be well covered at sides and on top.

The bulking should be done about the time summer weather is beginning, that the tobacco may not be chilled when it goes in the bulk, and the weather conditions can be depended on for favourable results.

It should remain in bulk four to six weeks before prizing. It must be borne in mind that the sweating of these tobaccos is an entirely different process to the sweating of cigar leaf.

Cigar Leaf.

During my visits to Northern Queensland, I have examined carefully much of the soil, and am of the opinion that a great deal of the land is suitable for tobacco-growing. More especially is the land from St. Lawrence to Mackay, about Bowen, and on the Lower Proserpine, especially on Kelsey Creek, very desirable for the purpose, on the Burdekin and in towards the coast from Woodstock.

As the climate has quite as much to do with the production of good tobacco as the soil, *we cannot fully determine* whether or not these factors will produce a superior quality until the experiment has been tried. It HAS been tried in a very small way at the Proserpine and on the Murray, and *the results were most satisfactory,* sufficiently so to demonstrate that those who will take up tobacco-growing in these two districts, and who are careful and painstaking, will get satisfactory results. The experiment is certainly worth trying, and those who are first in the field to make a success of it will be richly rewarded for their labour.

Good cigar tobaccos have always been scarce, and fetch high prices in the world's great markets—prices that will justify hiring labour for the work.

Sydney and Melbourne are large buyers of cigar leaf, and if a superior leaf is grown here a market can be found for it; but intending growers should remember that buyers want good tobacco—the world is

full of worthless stuff, and to make it good requires care and faithful attention to every detail.

For the information of those who may desire to try the experiment, a few suggestions for their guidance will be of assistance, and I will state that nothing is hereinafter written but what is important, and should be carefully noted and followed, for failure is almost sure to result if the instructions are not fully adhered to in every particular.

To grow tobacco successfully and profitably cannot be done in a haphazard way, and those who attempt to grow in such a way must meet with disappointment and loss; on the other hand, tobacco is one of the most profitable crops grown if properly looked after.

Some things can be done in almost any fashion, but tobacco-growing is not one of them.

Soils.

The soil should be a warm, sandy alluvial one, well drained, and rich in humus or vegetable matter—a soil that is friable and capable of the finest tilth, and such a one as will retain its moisture. The content of clay should be small, or absent almost altogether, though a clay subsoil is not objectionable, but clay in the soil tends to make the leaves thick and gummy, which is objectionable in cigar leaf. The land to be planted should be at least 5 miles from the sea coast, that it may not be affected by the sea air, which injures its burning quality.

Ground should be prepared as heretofore directed.

When to Plant.

It is best to plant at a time when the harvesting will come on at the end of the rainy season as near as may be, and, in order to determine that, it must be remembered that it will take from six to eight weeks from time of sowing the seed until the plants are large enough to transplant. This is the usual time, though sometimes, under favourable conditions, one month is sufficient. After transplanting, when the plants have taken root, they will take from sixty to seventy-five days to mature.

The reasons for harvesting at the time mentioned are—that it is desirable to have the plant growing at a season when there is a humid atmosphere, which greatly improves the texture of the leaf, and that it is not desirable to have the hot drying winds while the tobacco is curing, as it will then be subject to changing conditions that make it green and splotchy, and the leaf is liable to be harsh and dry, whereas it should be soft and flexible.

Tobacco should never be hung in open sheds, but in closed-in, well-ventilated ones; neither should it be exposed to hard drying winds, either in sheds or fields; hence fields should be as much sheltered as possible.

Sheds should be built so as to prevent too rapid changes in the temperature, and so that the temperature will not get too high and cause

too rapid drying; hence, iron for roofing or sides is very objectionable. A good thatched or board roof should be used, and for the sides the same material, so arranged as to be able to ventilate freely when required.

Making, sowing, and treatment of seed beds is the same as directed under the head of Pipe Tobaccos.

Transplanting.

This should be done late in the afternoon. The rows should be 3 feet 6 inches apart, and the plants placed 18 to 22 inches apart in the rows. Select strong healthy plants with good lengthy stocks, and set them well down in the earth, pressing the dirt well to the roots. By having long stocks and setting the plants deep, the roots rest in the moist earth and will thrive better. In drawing the plants from the seed beds, it is best to take a three-tined steel table fork and raise the plant with it. This leaves a good bunch of earth clinging to the roots, and enables the plant to take root better. *Transplanting should be done after rain, or in cloudy weather, as much as possible; but if the weather be dry, water should be used to set the earth about the plant, and early next morning a light covering of grass should be put over each plant before the sun is up. If the weather continues dry for some days, it will be necessary to water the plants occasionally until they take root. This can be done by using a bucket of water and a cup. Pour about a pint over each plant. This should be done about sundown; it is not necessary to remove the grass covering when watering.*

In setting the plant, scoop out with the hand some of the earth so as to make a depression around the plant. This serves to keep the water from running away from the plant, and also, when the grass covering is laid over it, it will not press it down. The depression should be made deep enough to leave the plant standing erect when the covering is put over it.

Cultivation.

Clean cultivation is necessary. After the plants have taken root, the field should be gone over with a hoe, the earth loosened about the plants, and the weeds chopped out. When the plants are 3 or 4 inches high, a Planet Junior with the small points should be run between the rows. The Planet Junior should be well opened out, and run as close to the plant as possible without cutting it up, and it should be run to its full depth to form a loose root bed that the roots may run and not be dwarfed.

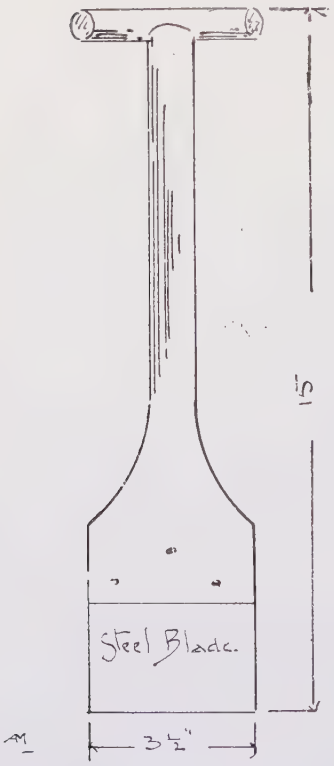
This ploughing should be done every ten days, but not run so close to the plant nor ploughed deeply until the plants are 12 or 15 inches high. Then a pony turning-plough with one horse should be used for hilling up. When this is being done, the plough should not run closer to the plant than a foot.

The tobacco should be kept free from grubs. The time to look for these is early in the morning. Later on come the topping and priming,

which should be done promptly when the time arrives. Topping is pinching out the seed bud, and priming is breaking off three or four bottom leaves to let the air circulate under the plant. Topping and priming should be done at the same time; and after this is done, there should still remain on the plant eighteen or twenty leaves.

Do not let your plants flower, except such as you want for seed. After topping, suckers will shoot up from the base of the plant and where each leaf joins the stalk. These should be kept broken off, and not allowed to grow to any size. Suckers will have to be taken off two or three times before the crop ripens.

Harvesting.



Knife for Cutting Tobacco —

Tobacco should not be cut until fully ripe, but it should not be allowed to get over-ripe. It is ripe when the leaf begins to droop, and shows a rough surface and brown spots appearing on it. In the early morning, if the ripe leaf is folded it will split along the fold. Cutting should not be done in the heat of the day if the weather is hot.

The stalk should be split to within 6 or 8 inches of the ground, and then cut off at the ground, gently laid down with the butt towards the sun. Let it lie until it is thoroughly wilted, which will take from thirty minutes to an hour, according to the weather. After it has wilted, hang it astride a stick. Other methods of harvesting are practised, such as spearing the stalk, also gathering the leaves and stringing them; but the above is the simplest to beginners. In hanging on the stick, each plant should occupy a space of at least 6 inches to prevent crowding—that is, fully 6 inches between the plants.

For convenience, a scaffold can be erected on the field, and the sticks of tobacco hung on it for two or three days until thoroughly wilted; but it is better to take it to the shed if convenient to do so, and hang it on the lower tiers; but, if a scaffold is necessary, it should be made under the shade of a tree so that the *hot* sun will not shine on it. Care should be taken that no rain falls on it after it is cut. Tobacco should never

be cut when wet from either dew or rain, and after a good rain should not be cut for three or four days, unless it is already fully ripe.

When taken to the shed, the sticks must not be hung too close together, but so placed that the tobacco on one stick barely touches he tobacco on another. It should be opened out well on the sticks. If this care is not taken, it may house-burn and stem-rot, either of which mishap destroys its value.

After hanging in the shed, give plenty of ventilation for the first two or three weeks, but protection from hard winds must be afforded. After this time so much ventilation is not needed, but it is not advisable to have the shed too close.

In curing tobacco the conditions should be as uniform as possible, or any changes should be very gradual.

Fire should not be used in curing cigar tobacco, except when the weather continues wet and it is likely to be damaged, and then only for an hour or two at a time; then stoves should be used for drying-out the shed, but the pipes should run outside and no smoke allowed to get on to the tobacco; or charcoal pans may be set on the floor after the smoke has burned off.

Selecting Seed Plants.

In saving seed, care should be taken in selecting plants that are strong, and that each seed plant should show the same characteristics. By this is meant same shaped leaves, equal distance on the stalk, growing in the same position, &c., &c. This is necessary if you are to keep the type, and this you will understand when it is noted that when tobacco seed is introduced into a different locality its tendency is to break up into various types, and eventually to establish a type that would naturally be peculiar to the country; hence, by carefully selecting a type for a few years, we are enabled to fix it. It is a good plan to save enough seed one year to last for three or four years. By this means you do not get away from the original so readily, if a mistake is made in selecting the seed plants. When the plant seeds, allow only one head to run up, cut off all branching heads, so as to allow only fifteen or twenty seed pods to form on the central spike. By this means the whole growing strength of the plant is thrown to these few pods, and strong healthy seed is formed. This is important.

Do not strip the leaves from the seed plants until the seed has fully matured. When the seed has matured, cut the stalk off 5 or 6 inches below the seed pods, and hang head down in a dry place until the pods are thoroughly dry.

The cigar-leaf industry is a valuable one, and, if once developed in this State, will be found to be exceedingly valuable to the small grower, especially to those farmers who are at some distance from shipping points and have to haul their produce considerable distances. To such

farmers I especially commend the crop; at the same time it is a profitable crop to all farmers when a high-grade leaf can be produced, and I feel satisfied that a high-grade leaf can be produced in the districts I have mentioned; and it is sincerely to be hoped that the effort will be made by some of the farmers in these districts with the view of growing it commercially as a regular crop, and not as a curious experiment.

Intending growers can secure suitable seed from the Department of Agriculture and Stock. Address the Under Secretary. Always state whether cigar or pipe tobacco seed is desired.

Pipe varieties—White Burley; Broadleaf Gooch; Connecticut Broadleaf; Blue Pryor.

Cigar varieties—Cuban; Havana.

Fermentation of Cigar Leaf.

Cigar tobacco is never suitable or ready for making cigars until it is fermented, at least to a sufficient degree that some idea can be formed by the buyer of its flavour, and while this is often done by the manufacturer, when it is possible to do so, and especially when the tobacco is put on the open market, the grower will find it to his interest to do it himself, and in order to enable him to do so I give some directions for bulk sweating.

This should be done in warm weather or a warm room. It is best to have a raised floor that the air may circulate well under it. The tobacco should have a moisture content of about 23 per cent. to 25 per cent. It should be bulked not less than 1,000 to 1,500 lb. in the bulk, more if possible; bulk should be made wide enough (say, 6 feet) and long enough (say, 8 or 10 feet) so that weather changes will not affect its sweating. It can be either bulked or placed in bins, but in either case it must be closely and well covered, sides and top. Before commencing the bulk, spread tobacco trash and broken leaves over the floor 5 to 10 inches deep, and on top of this smoothly and carefully bulk the tobacco. As the bulk goes up place large hollow bamboos in the bulk near the bottom, in the middle, and near the top. Let one end of this bamboo rest near the middle of the bulk and one end project, and in these thrust thermometers full length so they will rest near the centre of the bulk. These thermometers should be examined twice a day, and when the temperature reaches 135 to 140 degrees, then break the bulk down and rebulk it, being careful to take sides, top, and bottom tobacco and put in the centre of next bulk, and the centre of bulk on outside, top, and bottom. This is called reversing. This breaking down and rebulking will have to be done several times until the temperature ceases to go so high, but when it has reached a point under 135 degrees and then begins to fall, then the sweat is finished. No. 1 and No. 2 tobacco can be sweated in same bulk, but must be kept separate. It is best to bulk the tobacco when the weather is rainy and soft, and it has become quite soft from the weather. When rebulking, always shake out the tobacco well.

APPENDIX A.

Tobacco: The Production of Light-Coloured Pipe and Cigarette Leaf.

(Reprint of Bulletin issued by the Department of Agriculture, New South Wales.)

C. J. TREGENNA, Tobacco Expert.

Soils.

A light, friable, sandy loam is the most suitable for the production of a good quality tobacco that will give the desired aroma, texture, and colour. The plant is, however, easily affected by climate and by the chemical and mechanical conditions of the soil. Bright-coloured tobaccos are usually produced on light-coloured soils, and dark leaf on dark soils.

The presence of clay has a great influence on the product, and it will be found that a proportion of 8 to 10 per cent. of sand to one of clay is most likely to produce bright or yellow tobacco. Large proportions of clay will produce a tobacco which cures out a dark colour.

The subsoil is another important factor. It is desirable that it should underlie the soil at a depth of about 12 to 18 inches, and that it should contain a larger proportion of clay than the soil above. It is found that where the subsoil is too near the surface the tobacco is inclined to cure out a darker colour. On the other hand, it must not lie too deep, for the sandy nature of the surface soil may allow moisture to get beyond the reach of the plants, which may thus suffer from insufficiency of moisture should a dry spell occur during the growing season. Thus the subsoil should lie neither too near the surface nor too deep, and within 18 inches of the surface is most satisfactory.

In new localities the suitability of the local and climatic influences should be determined by experiments before tobacco-growing on a large scale is attempted. It is not advisable to attempt to grow the crop within 10 to 15 miles of the coast, as the "burn" of the tobacco is injuriously affected by the presence of chlorides in the atmosphere and soil. The land should be well drained, and the soil as free as possible from weeds.

Preparation of the Ground.

The land should receive a thorough ploughing early in the winter, and as soon as weeds appear thereafter, or a crust is formed on the surface, the spring-tooth cultivator should be used. The operation will not only kill the weeds, but will conserve moisture and sweeten the subsoil. Shortly before the season for transplanting, a second ploughing should be given to a depth of 9 inches, and the soil harrowed to produce a fine tilth, so that the rootlets of the tobacco plants may be hampered as little as possible in their search for nourishment.

As tobacco should arrive at maturity in two to two and a-half months after transplanting, the grower requires to give careful attention to the preparation of his ground. With anything like unfavourable soil conditions the rapid and healthy development of the plants is bound to be interfered with, and it should be the concern of the farmer to do all that is within his power to prevent such a state of affairs.

Working-up the Seed-beds.

In the growing of tobacco, care and trouble in the preparation and subsequent treatment of the seed-beds are amply repaid.

The last week in August is early enough to start sowings of seed, and this should be continued at regular intervals of a week or ten days up to the first week in November, so that the grower may be assured of a sufficiency of plants whenever the weather is favourable for their removal to the field after danger from frosts is past.

The site chosen for the seed-beds should be in a position sheltered from prevailing winds, and the soil should be a well-drained, rich, sandy loam. First mark off beds 4 feet wide; then pile a quantity of timber and brushwood on the surface, and start a fire on the leeward side, the intention being to raise sufficient heat to kill insect eggs and seeds of any weeds that may be present. Rubbish of any size should be raked off, but the fine ashes should be left, as these will act as a fertiliser when worked into the bed. Then the surface should be broken to a depth of 5 or 6 inches, and worked up to as fine a tilth as possible. The bed should be enclosed with a framework of wood. If squared timber is not available, straight logs about 6 to 9 inches in diameter will answer the purpose.

To Ensure even Sowing.

To ensure even sowing, one level teaspoonful of seed is sufficient for a bed 4 feet wide and 25 feet long, and should yield enough plants for 1 acre.

Do not attempt to sow the seed without addition to its bulk, but get two buckets, one of which should be about one-third filled with fine ashes. Place a thin layer of ashes in the empty bucket, and sprinkle as evenly as possible a pinch of seed over it; add another layer of ashes, and mix well. Repeat the process until the quantity of seed it is desired to sow is used up, together with the ashes. Give it a good mixing again with the hands. The early morning will probably be found the best time to sow the seed, before the wind becomes troublesome. It is inadvisable to sow with a strong wind prevailing, if it can possibly be avoided, as the seed is so light that it will be blown away. The mixture of ashes and seed should be distributed over the bed as evenly as possible, and the colour will be a guide as to its evenness. The seed should not be raked in, but after sowing the bed should be gently firmed all over with a piece of flat board. Then lightly water the bed several times with a can that has a fine rose. Do not put on so much at one time that it will run in small streams, but moisten the bed thoroughly.

Raising the Plants.

It will now be necessary to cover the beds for protection against cold, the sun, and insects. A simple plan is as follows:—At each end of a bed drive one small post, leaving it about 12 inches above the ground level, and strain a length of No. 10 wire from one to another, so that it runs down the middle of the bed; place a few small posts along the bed to take up any sag. Attach to the wire white hessian or cheese-cloth. This may be stitched

to the wire tightly with binder twine or string with the aid of a packing needle. The covering should be stretched tight and fastened to the sides by hooking over nails.

As it is advisable to have plenty of plants at the right stage when required, provision should be made for 50 per cent. more beds than are apparently necessary. One hundred square feet of bed is sufficient for an acre, but the bed will require to be pulled over a period of a few weeks, and the grower should not miss an apportunity of getting out as many plants as possible at one time when the weather conditions are favourable. Then, too, the danger from loss of plants by destruction by insects and other causes must not be overlooked. Over a number of years, the grower will find the average of 50 per cent. extra will amply repay him.

If the soil is inclined to pack after sowing, scatter over the bed very lightly some fine, well-rotted horse manure. If it is anticipated that the soil is likely to pack in this way, the manure should be incorporated in the bed before sowing.

In about one month the beds will be ready to be uncovered, and the seedlings to be hardened off before transplanting. This should be done gradually. For the first few days, if the weather is very hot, cover up in the middle of the day until the plants can stand the direct heat of the sun.

Plants which come up too quickly in the seed-beds are apt to be weedy and spindly specimens, and should be thinned out so that each occupies an area of about a square inch.

If plants are not coming on as fast as it is wished after they are up, a sugar bag may be filled with horse-manure, the neck tied, and the bag soaked in a cask of 40 gallons of water for a day. The liquid can then be freely used twice a week on the beds with a can that has a fine rose.

Pests of Seedlings.

The beds should be covered every evening and not uncovered until sunrise. Possibly the grower has not been troubled with the moths which lay eggs on the seedlings and develop into the caterpillars commonly known as "Stem Grubs" or "Tobacco Leaf Miners," and which work their way through the leaf tissues into the stem and stalk, and it is well to take some precaution. If the grub is present, or feared, spray the plants when they have four leaves with two teaspoonfuls of arsenate of lead to 1 gallon of water, and at an interval of four days later repeat the spraying.

Look out for cutworms, as they work havoc in the beds if neglected. If their presence is suspected, for two evenings before sowing lay baits on the seed-beds and the surrounding cleared land. The bait is made with 1 lb. arsenate of soda, 8 lb. treacle or sugar, and 10 gallons of water. Dissolve the arsenate of soda in 1 pint of boiling water, add the sugar or treacle, and the water, cut up some greenstuff, and mix all together. Pollard also may be used in place of greenstuff, and, if so, it should be mixed to the consistency of porridge. The quantity mentioned should be enough for the seed-beds for 10 acres of plants.

To Hasten Development.

Possibly it is required to obtain plants quickly, and in the following manner growers may expect to have them ready for transplanting in about six weeks. Before sowing, lightly cover the whole bed (so that it may be plainly seen) with high-grade superphosphate; about 3 or 4 lb. will be

required for each 100 square feet of seed-bed. Take a rake and **lightly** draw it over the bed once, and then sow the seed. When the plants are well up (which should be in about three weeks), soak a sugar bag full of horse manure in a 40-gallon cask of water, and give the bed a good watering. This should be repeated weekly. Plants so grown will do well in the field, but it must be understood that the grower **cannot** obtain plants quickly if the ground is not warm and the weather spring-like.

Keep the beds moist, but not wet, until the plants are well established. It is important that the beds should never be allowed to become dry on the surface while the seed is germinating. After the plants have reached some size it is better to thoroughly water occasionally—not too often, but **thoroughly** when it is done. This will reduce the danger from mould.

No fixed rule can be given for watering, but do not water beds which are uncovered while the sun is at all strong.

Transplanting.

When the plants are from 6 to 8 inches in height and well hardened off, they are ready for setting out. Plants which are stunted and yellow, and which have long pointed leaves, should not be used. The best are those which are most vigorous looking, and with short, broad leaves. If the beds are dry and hard they should receive a good soaking some little time before the plants are drawn, as it is necessary that as little damage as possible to the root system takes place, and the earth adhering to the plants should not be interfered with more than can be helped.

The best way to remove the plants is with a three-pronged fork. If the tap-root is long, it should be trimmed off with a pair of scissors to about 2 inches. The less handling the plants have the better, and after they have been drawn they should be placed, root downwards, in a cool place, and kept covered with wet bags. Only the plants that can be set out on the same day should be drawn at the one time.

It may here be stated that where the aim of the grower is to produce a fine-textured leaf, the plants should be set out close together, and although past experience must be taken as a guide, it will generally be found that a space of 2½ feet in rows 3 feet apart on light sandy loam will not induce heavy growth and coarse texture. This distance of 3 feet between the rows will allow of horse cultivation, and thus lessen labour.

A simple and effective way to mark out the land is to attach four light chains spaced 3 feet apart on a light pole with a handle, so that a man can drag it behind him and walk in accordance with sighting poles fixed for that purpose.

The ideal weather for planting out is just before and during rain, so that the roots of the plants may have very little check, and growth may be established as soon as possible. Unfortunately, however, weather conditions do not always suit the planter, and possibly owing to the lateness of the season he is forced to set out during dry weather. In this case holes should be made and filled with water, and the plant carefully put in and the earth well packed round the roots. Care should be taken that the roots are not doubled up, and that the hole is properly filled with earth. A simple test is to pull the tips of the two top leaves gently in an upward direction, and if they break off in the fingers they are right. Another method where irrigation is not carried out, is to make a hole close to the plant and fill with water, and then cover up to prevent evaporation. If the weather continues hot after transplanting, the plants should be shaded with grass. Paper folded in the shape of a tent and

held down by two clods of earth is also very effective. It may be necessary to water, and, if so, it is best done early in the morning or about an hour before sundown. Plants which have struck well usually start growing in about ten days, and the covering may be removed.

If irrigation is carried out, a good plan is to turn two shallow furrows together with a light plough, and run the water so that the ridge gets a good soaking some little time before transplanting. The plants should then be set out on the shady side of the ridge, care being taken that the stem and leaves are high enough above the water to avoid being submerged.

As soon as possible after transplanting it is advisable to run water through again to set the earth well round the bottom of the roots. After five or six days the crust around the young plants should be lightly stirred and broken.

Cultivation.

Tobacco quickly responds to cultivation, and the grower should aim at keeping his land in fine tilth, and free from all weeds up to the time the plants are ripening. During dry weather, by creating a dust mulch, excessive exaporation of moisture is avoided. The root system of the tobacco plant is largely near the surface, and for that reason shallow cultivation must be practised. As soon as a crust is formed, or the ground becomes hard, get to work with the horse cultivator and hoe, and when the plants are high enough, arrange the tines of the cultivator so that the earth is gradually drawn from between the rows towards the crown of the plants. Pronounced ridging will induce the drying-out of the soil, and should be avoided. Neglect of cultivation shows itself very clearly in the value of the tobacco, and no plant is so easily affected. It may be stated generally that the crop should receive a thorough cultivation every week or ten days after the plants have started growing until such time as the horse cultivator cannot be used without damaging the leaves of the plants owing to their size.

Where irrigation is carried out, cultivation must take place as soon as the ground begins to harden or crust. It is useless to water alone if good results are expected.

The bottom leaves are almost invariably damaged and dirty. These, generally numbering from four to six, should be removed, and the sap will then be taken up by the remaining leaves, which will be well off the ground.

Topping.

When the flower head or inflorescence has started to develop, the top length of stalk must be broken off. Plants which are strong and vigorous are topped high, and those which do not present these features are topped low. Experience and a fine judgment is necessary to determine the number of leaves that should be left on a plant, but for a normal season twelve to fourteen would seem to be about the number that should be left to mature. Where the entire plant is to be harvested, the planter should aim at obtaining as even ripening as possible to enable him to secure a good uniform cure and quality of product.

Suckering.

Soon after topping has taken place, and sometimes before, suckers will appear at the junction of the leaves and at the bottom of the stalk. As soon as they are about 2 inches long, or large enough to be conveniently grasped, these must be removed. Care must be exercised that in breaking them off the remaining leaves are not torn or damaged. It will be found that early in the morning is the best time to carry out this work, as during the afternoon of a

hot day they are tough and leathery. The operation of suckering will most probably have to be repeated each week. Particular attention should be paid to this work, because if suckers are allowed to go far, the quality of the tobacco will be seriously impaired.

Harvesting.

Some three to five weeks after topping, maturity will be reached, and there will be various indications that the time for harvesting has arrived. The varieties which have been distributed by the Department, if planted under suitable conditions, on reaching maturity, should show lighter shades of green, a golden sheen when looked at in certain lights, and in some cases a yellowish blotchy discolouration, or yellow spots. When the leaf is folded between the fingers, too, it will crack across.

Plants should not be cut or handled while the dew is still on the leaves, or after rain, until the gummy feeling has returned to the leaf.

There are several methods of harvesting.

The "Priming" Method.

It will be observed that all the leaves on the plant do not ripen at the same time, but in all cases they start to mature from the bottom upwards. To secure the best results, and obtain an even cure, each leaf should be taken off separately as it reaches maturity.

The leaves are then placed in baskets or other suitable receptacles and taken straight to the barn to be strung in the shade, care being taken that after "priming" they are kept out of the sun as much as possible. The leaves are then made up into "hands" containing four in each. A 4-feet stick will take about twenty "hands," ten on each side. In each "hand" of four leaves two should face one way and two the other, the middle two having their backs together. When the tobacco is to be flue-cured, the "hands" should not be jammed up close together, but there should be a space of a few inches between each on either side of the stick. Where air-curing is practised, the leaves should be placed **close** together until they have assumed a yellow colour, after which they should be opened out as above.

The method of stringing it is somewhat difficult to describe. The stem-butts on each "hand" are strung with a twist of the string to hold them together. The string, which is about twice as long as the stick, is held fast permanently at one end by being pressed into a slit in the wood, and when the required amount of tobacco has been strung, the loose end of string is run through another split at the other end, and made secure. The grower quickly finds out how it is done, after a trial or two.

Hanging may also be carried out by threading each leaf with a needle and twine through the midrib, but the process is a tedious one. Yet another method is to put fixed wires through the curing stick, so that they project 5 inches on each side, and are 7 inches apart. The leaves can be hung on the wires by piercing through the stem-butts. Leaf so strung is very liable to damage by tearing when the stick is being handled, and it is not possible to bulk down without removing the leaves from the wires.

Harvesting the Whole Plant.

When the whole plant is to be harvested, a fine discrimination must be shown in order that the largest proportion of leaves shall be at the right stage to ensure a satisfactory cure afterwards. As stated above, the whole of the plant does not ripen at the same time, and where the whole plant is to be

harvested and cured it must be cut when the middle leaves have matured. The plant should be split down the middle to within a few inches of the bottom, and then chopped off and placed astride the curing stick. The stick must be carried so that the leaves will be clear of the ground, as otherwise dirt may adhere to the leaves and depreciate their appearance and value.

The Method Recommended.

A combination of the two harvesting methods—the "priming" method and the whole plant—is recommended to growers as productive of satisfactory results without the labour involved by "priming" throughout. When the bottom leaves of the plants have come to maturity they should be primed off and strung, and the upper leaves left until they are ready, when they should be taken off with the stalk attached and strung, as in the case of harvesting the whole plant.

Curing Tobacco.

With very few exceptions, the methods of curing adopted in this State are not such as ensure the best results from the leaf as grown. It should be understood that mere cutting, scaffolding, and hanging in an open shed can never be expected to give good uniform results. Leaf so treated is just dried out. This State is subjected to rapid changes of climatic conditions, and tobacco which is left solely to the wiles of the weather invariably suffers.

What is termed "sun and air drying" has in the past been the method usually adopted, but it has rarely produced the bright or yellow tobacco now sought for by the manufacturers. Local buyers state that Australian tobacco so dried has an aroma which is peculiar, and not agreeable. Tobacco which has a pleasant aroma is usually agreeable to the palate; and it is this the grower has to cater for. All our remarks must be taken to refer to the curing of the bright and yellow tobacco, which it should be the aim of every grower to obtain.

Air-curing.

As tobacco is so easily affected by climatic conditions and rapid changes of temperature, it is necessary, if the leaf is to be air-cured, that the grower should have at his command a building which can be closed up or opened, as becomes necessary, and the ventilation of which can be perfectly controlled. In continuous wet weather the grower must be able to allow a current of air through his barn; and if dry, hot weather prevails, it must be possible to close the building up completely to prevent too rapid drying of the leaf, or to open the ventilators during the nights. If the leaf is showing signs of fungus, or "pole burn," and the weather is wet, charcoal or corncob fires should be placed in the barn, and the ventilators opened until the excess of moisture has departed.

Sun and Air Drying.

Where curing is effected by means of an open shed, as is the usual custom in this State at the present time, the tobacco should be cut late in the afternoon, and hung on the sticks close together. When it has wilted it will be possible to pack much closer. A scaffold should be erected close to the shed, the sticks of tobacco placed close together, and allowed to remain so until the leaf has assumed a yellow colour. When this change of colour has taken place, each stalk should be separated by a space of about 6 inches, and the stick taken to the barn. Growers should note that in the barn the sticks must have sufficient space to allow a free current of air to pass through the tobacco;

it is a great mistake to let the leaf be crowded together in the shed. Tobacco which shows every promise on the scaffold of securing a good colour is often spoilt by neglect of this precaution, and the result is a dark and dingy coloured leaf.

There is another point which growers would do well to observe: they should see that when on the scaffold the leaf does not get burned by the sun. If it is not possible to place the scaffold in such a position that it will be shaded during the middle of the day, a covering of cheese-cloth should be passed over all the leaf to break the rays of the sun, so that it may go into the barn of a yellow colour instead of a dark-brown. Tobacco on the scaffold should **never** be allowed to get wet; and a good cure cannot be expected if this happens.

Flue Curing.

To successfully flue-cure leaf, the grower must have considerable experience. Few barns of tobacco can be cured alike, and almost every one requires different treatment. In a very short space of time a barn full of leaf may be totally spoiled through neglect, lack of knowledge, or a little bad judgment.

To cure in this manner special buildings are necessary; they must be draught-proof, and so finished that heat and moisture cannot escape; and they must be erected of materials which will permit the interior to be affected by outside temperature to only a minimum degree. Iron erections are, therefore, totally unsuitable, while brick is expensive. It is suggested that the building should be erected of wood or pise. The inside dimensions of a building suitable to cure the crop of 6 or 7 acres would be 16 feet by 16 feet, and 17 feet high, with a spacing of 3 feet 6 inches vertically between the tiers on which the sticks of tobacco are hung when harvested on the stalk, and 2 feet when the leaves have been "primed." Two furnaces should be provided at one end of the building, and from it flue-piping of heavy Russian iron should run round inside, with the outlets between the two furnaces. Ventilators are necessary at both the top and bottom of the building, and may be provided by two rabbit-hutch types on each of the four sides at the bottom, and two cupola ventilators at the top. Plans will be forwarded to any grower desiring to erect such a building on application to the Department of Agriculture.

As already stated, considerably experience is necessary to successfully flue-cure tobacco, and no definite rules can be laid down, as each type of leaf is a factor of importance, and each barn-full differs from its predecessors.

There are three stages in curing. They may be stated as follows:—(1) Yellowing, (2) fixing, (3) killing. No fixed formula can be given, but if the following is taken as a basis the grower will, after curing a few barns, be able to modify or vary the process in some respects to give him the desired results.

As soon as the barn is full close the building right up, start the fire going, and bring the temperature up to 90 degrees Fah. Keep it at this point for eighteen to thirty-six hours, according to the condition of the leaf, limiting the time to the shorter period in the case of leaf that is quite ripe, and allowing the full period where the leaf is not so well matured. If the leaf is not yellowing as it should, place sacks on the floor and soak them with water to produce a moist heat; or, better still, if a boiler is handy introduce steam. When the leaves have assumed a nice yellowish colour raise the temperature to 100 degrees, at the rate of 5 degrees each two hours, and keep at this figure for some six hours. Then raise the temperature to 105 degrees and give a little ventilation top and bottom, opening the ventilators a few inches. In these directions it is presumed that the curing-room is one that has been erected in accordance with proper plans, such as would be supplied

by the Department of Agriculture, as stated above. In such a building, both temperature and ventilation could be controlled so as to produce the results desired.

Having obtained the temperature of 105 degrees with the limited ventilation mentioned, the conditions should be maintained for three or four hours. Then increase the temperature to 110 degrees, and also increase the ventilation to about one-half of the capacity of the ventilators, and hold at that for three hours. Do not raise the temperature above 110 degrees until the tips of the leaves have dried, however. Next, again raise the temperature to 115 degrees for six hours, giving **full** ventilation, and then again advance to 120 degrees for two hours with full ventilation. The most critical time is between 110 degrees and 120 degrees. If the heat is too fast the leaf will splotch or blister, and if too slow it will sponge. When the sweat can be observed on the leaf, and it will not go off at once, the temperature must be increased rapidly by 10 degrees, and all available ventilation given; but if ventilation is given as directed there is little fear of sponging.

After remaining at 120 degrees for six hours, leave the ventilation at full, and increase the temperature by 5 degrees every two hours to 135 degrees; beyond this do not further increase the temperature until the blade of the leaf has dried out completely. Then exhaust all moisture by raising the temperature every hour by 5 degrees to 180 degrees, and gradually decrease the ventilation until only a very little is left at the top. Keep at the latter temperature until the stems and stalks have completely dried out. Ventilation plays a **most important part** in successful flue-curing during the stage from 105 to 140 degrees, and growers should pay particular attention to this matter. The whole process will take five or six days.

Extinguish the fire as soon as the tobacco is cured, and open the doors and ventilators to cool it off for twenty-four hours. If the weather be very dry, the moisture content of the barn may be increased with the aid of steam, or by means of water thrown on sacks on the barn floor. When the tobacco is in a condition to handle without the leaves breaking, it should be taken down on the sticks and bulked until the grower is ready to grade and bale for market as opportunity occurs.

Stripping.

So much time and labour have necessarily to be expended by growers before the tobacco leaf is ready for stripping and bulking, that the adoption of correct methods at this stage is a matter of enhanced importance. Yet there are those who quite fail to realise the extent to which the quality may be influenced in the processes of stripping and bulking, and who are consequently disappointed at the eventual refusal of buyers to take the leaf at all, or at the very low price offered. A few suggestions should, therefore, be helpful to growers.

As soon as the stem and stalk of the tobacco have dried, and the atmospheric conditions will permit, the leaves should be stripped from the stalk, and made into "hands." Each hand should consist of twelve leaves, and should be made by binding the stem-butts with a leaf tightly and neatly passed twice around them, and by opening the hand in the centre and pulling the end of the binder through.

When stripping from the stalks, opportunity should be taken to sort the leaves into three classes, No. 1 containing only leaves that are of good bright or yellow colour, and undamaged, No. 2 containing the leaves that are reddish-brown and undamaged, and No. 3 containing dark leaves, such as are damaged and would not fall within either of the other two classes.

While not necessary with flue-cured tobacco, in the case of leaf that has been air-dried the hands should be re-hung on the sticks, and given as much sun as possible for a few weeks on a scaffold close to the shed. Care should be taken not to put out more stocks at one time than can be removed to cover at the approach of rain. After each lot of sticks has been "sunned," they should be hung in the shed for a further period of about two months, after which the hands should be bulked down, each in its own class, for some six weeks at the beginning of the warm weather.

Bulking Down.

For bulking the hands, the leaf should not be moist, but in such condition that the tips can be squeezed together without breaking, and that a slight shaking will release one from the other. Opportunity should also be taken of straightening out the hands to improve their appearance before putting into bulk. Leaves with "fat stems" (stems not dried out) should not on any account be included in the bulk, or mould will very quickly appear.

"Bulks" are made by placing two rows of hands, overlapping by about one-third of their length, with the butts outward. The height should not be less than 4 feet. The length will be determined by the amount of leaf to be treated. The larger the bulk, the less it will be affected by outside climatic influences.

Growers are advised to cover each bulk as it is completed with blankets or tarpaulins, and to place weights on top, the object being to conserve the heat and moisture, and to avoid the drying out of the leaf. The prime cause of mould is the bulk becoming moistened and chilled, and every precaution should be taken against this. The bulk should be placed on boards well off the ground, so that air may circulate freely underneath.

Each bulk should be carefully examined every day, and if one is found to be too warm it should be broken down, and after each hand has been well shaken and lightly aired, should be rebuilt, those hands which were formerly in the centre being placed on the outside, the outside layers in the centre, and the lower layers on the top.

Leaf that has been through the bulking progress satisfactorily shows an absence of gumminess, and also the presence of crystals, which, though minute, can be seen when the leaf is held up to the light.

APPENDIX B.

Flue-curing Tobacco Barns.

(Reprint of Pamphlet issued by the Department of Agriculture, New South Wales.)

General.

For the type of barn shown on the accompanying drawings, either concrete or pise may be used for the walls, in conjunction with squared posts set up at the corners and in the centre of each wall.

These posts are roughly squared above ground level, the round butts sunk 3 feet into the ground and the tops secured with the top plate temporarily fixed till the completion of the concrete walls. After securing the posts with the plates and temporarily bracing with a diagonal batten at each corner, No. 8 fencing wire, or, preferably, barbed wire, is placed in the centre of each wall. This wire should be placed at 24-in. centres, run through the centre of each post, and strained taut.

The concrete or pise filling may now be proceeded with; and it is here that the posts make for rapid and easy construction of the walls, besides being a source of great strength to the building as a whole. The boxing to receive the concrete or pise filling is formed by planks or lining 1 in. thick, reaching from post to post, each side about 3 ft. wide, cleated at each end and at 24-in. centres with 3-in. x 1-in. hardwood cleats.

With these linings temporarily but securely fixed to both sides of the posts, the concrete or pise filling may be proceeded with, care being taken that the boxes for ventilators are first fixed in position. This filling must be well packed, and to bond it with the work that is to come on top of it, the top must be left rough. It must also be soaked with water before filling in the next lift.

Concrete.

The following tables gives the ingredients and proportion for making concrete:—

No. 1—Cement Concrete.

Parts—

Cement 1, sand 3, stone broken to 1½-in. gauge 7; or
Cement 1, sand 1, cinders 7; or
Cement 1, river shingle 7*; or
Cement 1, coarse river sand 5.

No. 2—Lime Cement.

Parts—

Lime 1, sand 2, stone broken to 1½-in. gauge 4; or
Lime 1, sand 1, cinders 4; or
Lime 1, river shingle 4; or
Lime 1, coarse river sand 3.

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* The river shingle should contain about 50 per cent. sand, while the largest pebbles should be about 1½ in. diameter.

No. 3—Lime and Cement Concrete.

Parts—

Cement ½, lime 1, sand 3, stone broken to 1½-in. gauge 6; or
Cement ½, lime 1, cinders 6; or
Cement ½, lime 1, river shingle 6; or
Cement ½, lime 1, coarse river sand 5.

Mixing.

The measuring of the ingredients for the concrete is an important part of the work, and requires careful attention.

For all classes of concrete the mixing should be done on a wood or similar platform, and the mixture placed in position in the walls and well packed immediately it is mixed. Cement concrete that has been allowed to stand and become partially set is no good, and should not be used.

The face of the walls should be worked over with a wood float or trowel to an even but not necessarily smooth face, as soon as the boards are removed and before the material sets too hard.

No. 1—Cement Concrete.

For cement concrete a gauge box 4 ft. 6 in. long by 2 ft. wide by 12 in. deep, which equals 9 cubic ft., is a useful size, and requires one bag of cement, containing 1-1/3 cubic ft.

The box is first filled with the aggregate and afterwards, by using a movable partition placed in the centre, will serve as a gauge for the sand. These quantities to one bag of cement are the usual for No. 1 concrete, similar to the 1-3-7 mixture given in the table.

The ingredients must be well mixed by turning them over twice in a dry state, and twice whilst being wetted from the rose of a watering-can or hose.

No. 2—Lime Concrete.

To make No. 2 concrete, the lime is mixed in a hot, creamy state, first with the sand and then with the aggregate.

No. 3—Lime and Cement Concrete.

For No. 3 concrete, first mix the sand and cement together in a wet state, then add the lime, and mix the whole together with the aggregate.

Pise.

Pipeclay loam containing ironstone gravel is the most satisfactory for this class of work. Material which is too sandy will fret away, and one containing too much clay will crack. Any vegetation growing on the surface of the earth selected should be removed, as also should any roots, bits of stick, &c. The earth is best used as it is dug, and if too dry should be brought to the correct moist condition by watering it about two days before it is to be used. No amount of tempering after it is dug will render it as suitable as watering in the solid as described. The earth should be just moist enough to be crumbly, and yet adhesive enough to retain the impression of the fingers when pressed into the hand. If too moist it will stick to the rammer and work up squashy; if too dry it will work up loose under the rammer.

After the earth has been dug it should be reinforced with straw or long grass worked into it. It is then placed in the boxing in layers about 6 in. deep, and rammed tight.

Before erecting the forms to receive the pise filling, fix 3-in. mesh 18 gauge galvanised wire netting to both sides of the posts, care being taken that the netting is kept hard up against the forms during the process of filling and tamping.

Furnaces.

With all four classes of material it is advisable to build the furnaces with bricks laid in cement mortar, gauged one part cement to two parts sand. The bricks before being laid should be well soaked with water, whilst the finished work requires protecting with bags or the like for at least twenty-four hours from heavy frosts or the drying effects of a hot day.

If desired, the furnaces may be built with cement concrete mixed in the proportion of one part cement, three parts sand, and six parts of a suitable aggregate broken to 1-in. gauge.

A good class of igneous (volcanic) rock, such as basalt, granite, quartz, &c., is recommended for aggregate. Sedimentary rocks, such as sandstone, limestone, &c., are not suitable for this particular class of work. Unless absolutely certain of the fire-resisting qualities of the material it is advisable to submit samples for approval before going on with the work. Make the crown of the furnace 9 in. thick, reinforced with 1½-in. mesh 16 gauge wire netting, placed right over the crown 2 in. from the top.

On completion the work must be covered with bags as stated for brick furnaces.

Flues.

On the accompanying drawings the flues are indicated to be trenches cut in the ground, lined on either side with 4-in. concrete walls, and the top covered in with corrugated iron flattened out and bearing on the concrete walls, 4 in. There is, however, another type of flue in use, consisting of 12-in. diameter pipes made from 24 gauge galvanised plain iron with riveted joints. These pipes or flues should be laid slightly raised above the ground and pitched towards the chimney. Square brick pits are recommended for the angles in lieu of galvanised-iron elbows. These will be required to be of 14 in. by 14 in. internal dimensions, and 4½-in. walls, with the iron flues built in. The top may be covered over with a concrete slab or a piece of sheet steel or iron.

Variations the Grower may Introduce.

The attached specification is for the construction of a double barn, as shown on the plan, with lime concrete walls, and it is to be noted that the terms of the specification may in some respects be departed from to suit the purposes of the grower; for instance, he may fix the internal framing for hanging the leaf differently by using round timber in place of sawn, and even allow the sides of the flue trenches to go unlined with concrete if the ground is stiff.

The underside of the roof timbers may be lined with bags to catch the drip off the roof iron in lieu of the rubberoid specified.

SPECIFICATION of work to be done and the materials to be used in the erection of Flue-curing Tobacco Barns, as shown on the accompanying Drawings.

Materials.

Bricks. To be of good shape and well burnt.

Sand. To be sharp, gritty, river sand, free from vegetable matter.

Cement. To be Portland cement of Colonial manufacture, bearing test stamp of P.W.D.

Lime. To be lump lime, and quite fresh.

Cement mortar. To be mixed in the proportions of one part cement to two of sand.

Lime concrete. To consist of one part lime, one part sand, and four of clean furnace cinders, or one part lime, two parts sand, and four of stone broken to 1½-in. gauge. The whole to be mixed on a wood or similar platform, placed in the boxing, and packed whilst the lime is still hot.

Timber. Doors, shutters, &c., to be of Colonial pine. Drying racks and bearers of hardwood, and the balance either hardwood or Cypress pine. All to be cut to the full size stated.

Excavator. Clear the site of turf and all vegetable matter, and excavate to the depths indicated for flues, trenches, and furnaces. The trenches to be cut vertically, bottoms level, and the soil wheeled clear of the building.

Bricklayer. Build furnaces, bases of stacks, and the intervening walls with brick in cement mortar. Furnaces to be 2 ft. wide, 4 ft. 6 in. long to the bridge, and 2 ft. high from firebars to underside of the roof. The roof to be turned to a semicircle, with two 4½-in. rings. The bridges to be 9 in. in old English bond, carried up to within 12 in. of the roof, and bonded to walls.

Floors of ashpits to be brick on edge, laid on a bed of sand 2 in. deep, and grouted up with liquid cement mortar. Top of floors to be 9 in. clear of firebars at the bridge, and 6 in. clear at the opposite end.

Provide furnaces with cast-iron firebars spaced ½ in. apart and supported with 1¼-in. x 1¼-in. cross bars built into brickwork.

The brick casing to furnaces to be in old English bond, with bricks on edge for the top course. The whole to be grouted with liquid cement mortar.

Bases of stacks. To be 4½-in. work, bonded to walls, and to have 14-in. x 14-in. flues. The tops to be weathered round iron stacks with cement mortar.

Note additional fire-box shown on drawings. Firebox in base of chimney stack to assist draught is shown on plan and elevation, the fittings being those usually provided for ordinary copper boilers.

Construct the intervening walls, also the projecting nibs at the corners, with 9-in. work in old English bond, and leave vent-holes near furnace walls 14 in. high and 12 in. wide. Top course to walls to be brick on edge and the whole grouted solid as before specified.

The partition to the centre flue of each barn to be brick on edge in cement mortar.

To be of lime concrete, 18 in. wide and 12 in. deep. Footings under walls

Construct walls with 9-in. x 9-in. squared posts set up at corners, intersections, and doorways, also midway between corners. Put 4-in. x 3-in. top plates let into tops of posts and 5-in. x 2-in. bottom plates on edge sunk flush on outer face 6 in. above top of furnaces. Walls.

Put 4-in. x 3-in. trimmers on flat to heads of doors. For ventilators fix wood boxes the full width of the walls constructed with 1-in. stuff.

Put 9-in. diameter half-long sills to doors housed into the posts.

At 2-ft. centres put barbed wire horizontally through posts in the centre of walls, and strain taut.

Fill in between posts to the full height of walls with lime concrete 9 in. thick, the filling to be done in layers not more than 2 ft. high, and to be well packed.

Partition wall to be carried up to the slope of the roof and 15 in. above it. Corner and door posts of shed attached to barns to be sunk 30 in. into the ground as indicated on drawings.

To be 20 in. wide and 12 in. deep, lined on each side with concrete walls 4 in. thick. Cover over the flues with 26 gauge galvanised corrugated iron, supported with 1-in. x $\frac{3}{8}$-in. iron bearers placed 2 ft. apart on edge. Flues

Except where otherwise specified, to be constructed with hardwood, 4-in. x 2-in. rafters birdsmouthed over top plates and spiked to 8 in. x $1\frac{1}{4}$ in. pine ridge boards, projecting ends to be cut plumb and to a line. 4-in. x 3-in. tie beams (five to each barn), and 4-in. x 2-in. braces from rafters. Tie beams and braces to be secured to rafters and at crossing with $\frac{3}{8}$-in. cup-head bolts. Fix over roof battens before iron is put on 3 ply ruberoid to catch drip off iron. Roof.

Rafters to shed to be 4-in. x 2-in. at 4-ft. centres birdsmouthed over 4-in. x 2-in. wall plates. The plate against barn wall to be on edge and securely spiked to posts. Projecting ends of rafters to be cut as before specified. Put 3-in. x $1\frac{1}{2}$-in. pine battens to all roofs at approximate 30-in. centres for corrugated iron.

Construct the internal framework of each barn with 6-in. x 3-in. bearer on edge, notched into centre posts, and 4-in. x 2-in. wall plates at same level secured to posts with $\frac{1}{2}$-in. coach screws. Internal framework.

Build up five lines of drying racks with 4-in. x $1\frac{1}{2}$-in. horizontal rails at 24-in. centres let into and secured at centres and at each end to 4-in. x 2-in. uprights, the uprights to be secured to tie beams and to bottom plates and bearer with $\frac{3}{8}$-in. cup-head bolts.

To be of Colonial pine, constructed with 7-in. x $1\frac{1}{4}$-in. ledges, and 4-in. x $1\frac{1}{4}$-in. braces, sheeted over with 4-in. x 1-in. T. G. and V. jointed lining. Doors.

Doors to shed to be 7 ft. x 4 ft, hung in two leaves with 14-in. jap. tee hinges, and fastened with 8-in. galvanised tower bolts to head and sill, and one 10-in. galvanised pad bolt. Other doors to be 6 ft. 8 in. x 2 ft. 8 in., hung with 14-in. jap. tee hinges and fastened with 10-in. galvanised hasp, staple, chain, and pin.

Vent shutters to be out of 6-in. x 1-in. T. and G. lining. To have 2-in. x 1-in. cleats and to slide on 2-in. x 1-in. guides, the latter to be secured at ends to 2-in. x 1-in. verticles. Ventilators.

Plumber.

Guttering. Provide and fix to eaves on strong galvanised-iron brackets 4½-in. quarter-round 24 gauge galvanised iron guttering with lapped, riveted, and soldered joints.

Roof iron. Cover roof with 26-gauge galvanised corrugated iron fixed to 3-in. x 1½-in. battens with 1¾-in. galvanised screens and lead washers. The sheets to be lapped 6 in. at ends and 1½ corrugations at sides. Finish with 2-in. rollover gable rafters; also turn up the iron against party wall to make a watertight finish.

Skylights. Provide and fix in roof of each barn four skylights (two on each side), filled with 26 gauge plain galvanised iron in lieu of glass. Each skylight to be hinged, and to be operated from ground outside barn walls with Sampsone No. 4 sash cord running over two 1¾ in. galvanised side awning pulleys fixed to rafters.

Provide and fix in roof of shed four similar skylights. Two to be fixed, and two to be hinged and operated with sash-cord and pulleys as specified for barns.

Fix to walls, one to each skylight, and approximately 5 ft. above ground, wrought-iron eye bolts to screw with 1½-in. diameter ring for hitching cords of skylights.

Ridging. Cover ridges with 16-in. 24-gauge galvanised ridging, and box in at gables.

Down pipes. To roof guttering fix three lines of 3-in. 24 gauge galvanised down pipes, with shoes to discharge on to the ground. To be secured to wall posts with suitable galvanised iron bands.

Chimney stack. Provide and fix 12-in. diameter 18 gauge iron chimneys, one to each barn, and fitted with square flange at 4 in. from bottom end. Each to be 12 ft. high, set up on brick base and secured to wall posts at the top with tie wires. The bases to be weathered off with cement mortar as specified under Bricklayer.

Rendering. Partition walls, where showing through the roof, to be rendered ⅝ in. thick with cement mortar and steel trowelled. To be mixed in the proportion of one part cement to two of sand.

Painting. Doors and woodwork of ventilators to be stopped and painted with two good coats of the best white lead and raw linseed oil paint.

Plate 44.—New Banana Land.
The building is a packing shed; the background is typical Queensland scrub or jungle.

Plate 45.—On the same Plantation.
The outlook from the packing shed.

PLATE 46.—A GROVE OF "LADY'S FINGER" BANANAS—TWELVE MONTHS FROM THE TIME OF PLANTING—MARY VALLEY.

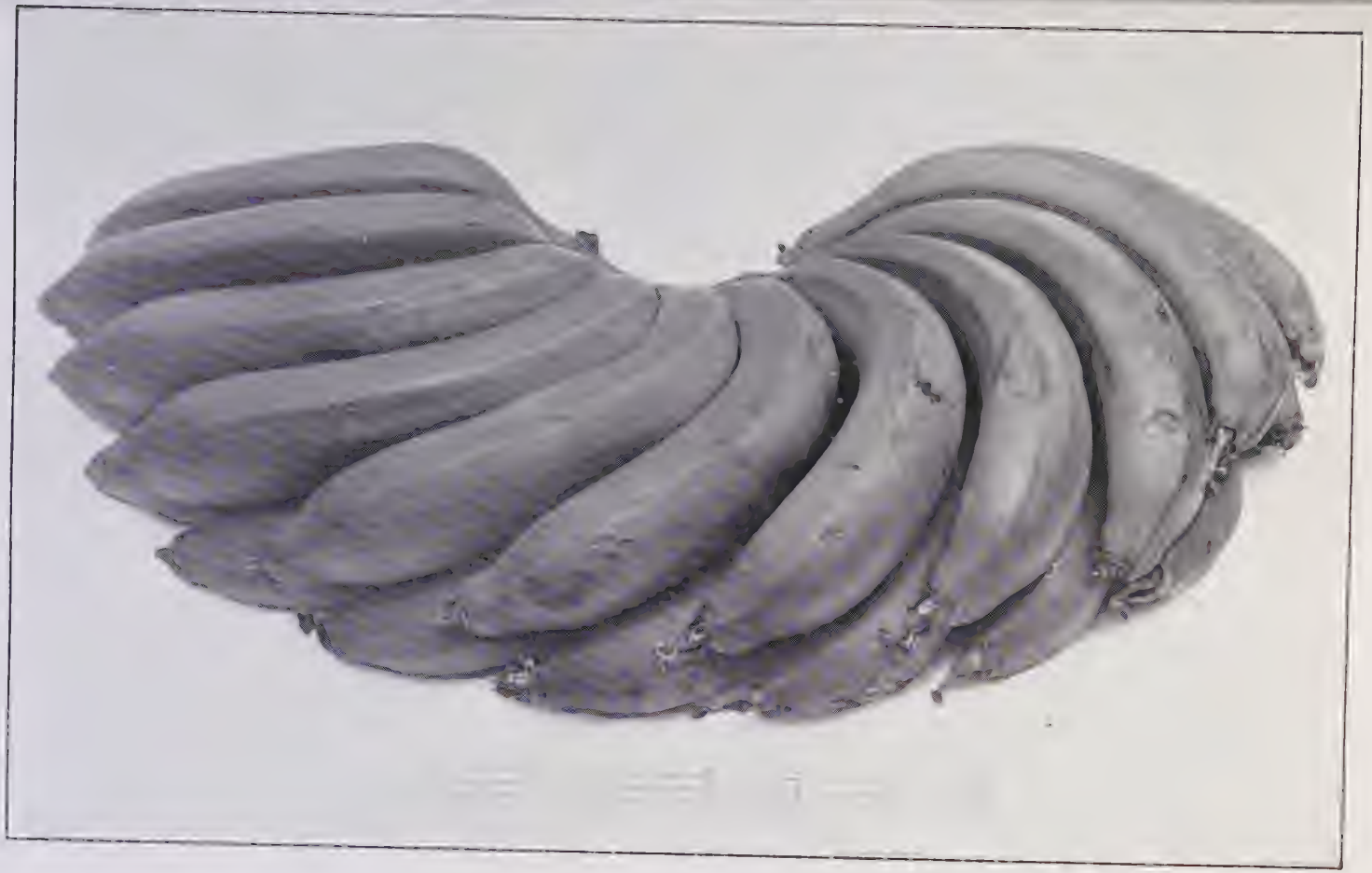

PLATE 47.—QUEENSLAND BANANAS.

A "hand" of the Cavendish variety grown in the Mary Valley. The "hand" contains 21 fruit, averaging 10 inches in length measured round the curve, and 5 inches in circumference. Total weight 9 lb

PLATE 48.—A MIDDLE YORKSHIRE STUDY.

Note the rugged outline and sturdy characteristics of this sire. It is interesting also to note the capacity of his mouth and the development of tusks.

THE DAIRY HERD, QUEENSLAND AGRICULTURAL COLLEGE, GATTON.

MILKING RECORDS FOR DECEMBER, 1923.

Name of Cow.	Breed.	Date of Calving.	Total Milk.	Test.	Commercial Butter.	Remarks.
			Lb.	%	Lb.	
Netherton Belle	Ayrshire	30 Oct., 1923	840	3·8	37·50	
College Cobalt ..	Jersey ..	14 Sept., 1923	780	4·0	36·30	
Fair Lassie ..	Ayrshire	28 Nov., 1923	759	3·8	33·99	
College Wildflower	Jersey ..	13 Aug., 1923	630	4 5	33·30	
College Grandeur	,,	11 July, 1923	540	4·9	31·20	
Dawn of Warragaburra	,,	10 Nov., 1923	630	4·0	30·60	
Magnet's Leda ..	,,	18 Aug., 1923	630	4·1	30·30	
College Cold Iron	,,	23 April, 1923	540	4·7	29·70	
Miss Fearless ..	Ayrshire	17 Nov., 1923	630	3·7	29·70	
Bellona	,,	3 Aug., 1923	630	4·0	29·40	
College Promise	Jersey ..	14 Aug., 1923	540	4·6	29·10	
Hedges Madge ..	Friesian	18 Aug., 1923	750	3·2	27·90	
Miss Security ..	Ayrshire	8 June, 1923	660	3·6	27·60	
Dear Lassie ..	,, ..	1 Nov., 1923	600	3·9	27·30	
Buttercup ..	Shorthorn	7 Sept., 1923	780	3·0	27·00	
Comedienne ..	Jersey ..	10 July, 1923	480	4·8	27·00	
Miss Betty ..	,,	30 Oct., 1923	600	3·8	26·70	
Lady Loch II. ..	Ayrshire	26 April, 1923	540	4·2	26·70	
Snowflake ..	Shorthorn	17 May, 1923	540	4·1	25·80	
Lady Meg ..	Ayrshire	14 July, 1923	570	3·8	25·50	
Yarraview Snowdrop	Guernsey	7 Sept., 1923	510	4·3	25·50	
Songstress ..	Ayrshire	22 Aug., 1923	510	4·2	25·20	
Lute	,,	26 April, 1923	540	3·8	24·00	
Confidante ..	,,	7 Sept., 1923	570	3·5	23·10	
College Hope ..	Jersey ..	21 Oct., 1923	480	4·1	23·10	
Gay Lassie ..	Ayrshire	5 July, 1923	450	4·3	22·50	
College St. Martha	Jersey ..	25 June, 1923	390	4·8	21·90	
College Desire ..	Ayrshire	11 July, 1923	480	4·0	22 20	
College La Cigale	Jersey ..	25 June, 1923	360	5·0	21·00	
Hedges Mattie ..	Friesian	21 Nov., 1923	600	3·0	20·70	
College Ma Petite	Jersey ..	12 June, 1923	480	3·6	20·19	
Mistress May ..	Ayrshire	20 June, 1923	480	3·6	20·19	
Lady Amy ..	,,	7 July, 1923	390	4·4	20·10	

WINTER GREENFEEDS.

EXPERIMENTS ON THE TABLELANDS.

The Northern Instructor in Agriculture, Mr. N. A. R. Pollock, forwards the following notes on Winter Greenfeeds on the Tableland:—

During the past four years the Department of Agriculture has conducted trials of various crops to provide a succulent and balanced feed for dairy cattle during the winter and later months, when pasturage is scanty or in short supply.

Attention has been drawn to the success of these crops previously in the Press, but it may not be out of place to republish the results obtained on the farm of Mr. R. Campbell, at Peeramon, in 1921, which in seasons of usual rainfall should be generally obtainable.

New scrub land under pasture for several years; ploughed early in April, after a crop of maize had been taken off for ensilage; seed sown 22nd April, yields estimated 3rd August; area, 3 acres.

Plot 1.—Blue field peas: Yield of green stuff (pods well set), 8 tons per acre.

Plot 2.—Grey field peas: Yield of green stuff, 15 tons per acre.

Plot 3.—Golden Vetches: Yield of green stuff, 8 tons per acre.

Plot 4.—Golden Vetches and Bunge Wheat: Yield of green stuff, 14½ tons per acre.

Plot 5.—Bunge Wheat: Yield of green stuff, 8 tons per acre.

Plot 6.—Amby Wheat: Yield of green stuff, 6½ tons per acre.

Plot 7.—Warren Wheat: Yield of green stuff, 9½ tons per acre.

Plot 8.—Florence Wheat: Yield of green stuff, 5½ tons per acre.

The time of harvest was opportune for the wheat varieties Bunge and Warren to weigh well; the latter especially was at its heaviest stage, just breaking into ear, whereas Florence was almost ripening off.

As a result of these, as well as of the experiments of other years, the following crops are recommended for sowings to provide green feeds for the winter and subsequent lean months.

Florence Wheat.

A good early dual purpose variety, especially suited to dry conditions; foliage, sparse to medium; stooling poor to fair; season, very early.

This wheat first introduced to the Tableland by the Department is now generally favoured, as it has been proved the surest cropper, more especially in the drier maize areas. Sowings should be made at the rate of 1½ bushels to the acre, owing to its poor stooling properties. If sown, combined with a legume, one bushel is sufficient with half a bushel of the latter. Two or three sowings could be made at intervals of three or four weeks between to provide continuity.

NOTE.—In speaking of a variety being early, mid-season, or late, the meaning is that the crop is of short, medium, or long period in reaching maturity. Where wheats are grown for grain, the late varieties are planted much sooner than the early varieties.

Warren Wheat.

A good dual purpose wheat; useful in dry country; straw, nearly solid; foliage, medium abundant; stooling, very good; season, mid-season.

This wheat is not such a sure cropper as Florence in a dry time, but under ordinary seasonal conditions in the dairy areas should be very profitable. If fed off when seven or eight weeks old, and then left for a final yield, much satisfaction should be obtained. Sow one bushel and a-quarter to the acre, or if combined with a legume, one bushel.

Bunge Wheat.

This is an early wheat, but requires for its success more rain than Warren or Florence, and also likes a heavier soil.

Golden Vetches.

This legume has done remarkably well in all trials, and should be grown in all winter feed crops. In the young state, matured, or as hay, it is relished by stock, and it is especially valuable when combined with a cereal, while the latter helps to support it. When grown alone, sow 30 lb. to 50 lb. per acre, and when sown with a cereal, 20 to 30 lb. with a bushel of the cereal.

Field Peas.

The grey field pea has given higher yields of green feed than the blue variety, but possibly the yield of seed or peas might be heavier in the blue—a factor to be considered if pigs are to be fed. Both varieties should be tried for comparison.

Sowings alone should be at the rate of 40 to 60 lb. per acre, and if combined with wheat, 20 to 30 lb.

Oats are not recommended on the Tableland, owing to their susceptibility to rust.

Skinless barley has been found to give fair yields, but not as good as those from wheat.

The wheat varieties (Florence, Warren, and Bunge) are all good rust-resisters, and in all trials have shown very little or no rust on the flag, when oats were badly affected.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING JANUARY, 1924 AND 1923, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of Years' Records.	Jan., 1924.	Jan., 1923.		Jan.	No. of Years' Records.	Jan., 1924.	Jan., 1923.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	12·02	22	5·76	6·99					
Cairns	16·68	41	7·90	3·81	Nambour	9·27	27	5·06	5·99
Cardwell	16·95	51	4·60	4·31	Nanango	4·52	41	4·45	3 38
Cooktown	15·01	47	6·43	7·46	Rockhampton ...	7·96	52	1·22	5·49
Herberton	9·66	36	6·38	5·35	Woodford	7·36	36	5·03	4·31
Ingham	16·30	31	7·35	6·46					
Innisfail	20·60	42	8·97	11·37					
Mossman	17·70	15	4·85	7·61	*Darling Downs.*				
Townsville	11·66	52	1·55	1·14					
					Dalby	3·32	53	2·64	3·37
Central Coast.					Emu Vale	3·06	27	5·15	3·15
					Jimbour	3·71	35	2·08	1·18
Ayr	12·09	36	1·93	0·32	Miles	3·85	38	2·85	2·48
Bowen	10·37	52	0·65	0·91	Stanthorpe ...	3·50	50	6·91	2·80
Charters Towers ..	5·77	41	0·30	6 28	Toowoomba ...	4·90	51	4·77	3·02
Mackay	15·13	52	1·35	8·65	Warwick	3·47	58	6·40	3·29
Proserpine	17·47	20	3 93	4·26					
St. Lawrence ...	10·04	52	2·12	6·22					
					Maranoa.				
South Coast.									
					Roma	3·40	49	2·51	2·28
Biggenden	5·40	24	2·05	5·59					
Bundaberg	9·17	40	1·48	8·22	*State Farms, &c.*				
Brisbane	6·32	73	2·27	2·79					
Childers	7·68	28	2·81	4·44	Bungeworgorai ...	2·22	9	2·61	2·33
Crohamhurst ...	12·56	30	7·13	4·56	Gatton College ...	4·20	24	2·38	2·39
Esk	5·54	36	3·92	1 95	Gindie	4·00	24	0·14	1·85
Gayndah	4·77	52	0 46	3·71	Hermitage ...	2·81	17	5·86	3·28
Gympie	6·73	53	2·07	5·70	Kairi	7·79	9	3·75	4·65
Glasshouse Mts. ...	8·82	15	7·70	3·30	Sugar Experiment Station, Mackay	16·46	26	1·82	5·95
Kilkivan	5 68	44	1·38	2 64	Warren	6·40	9	1·38	3·59
Maryborough ...	7·42	52	2·44	5·26					

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for January, 1924, and for the same period of 1923, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
State Meteorologist.

STAFF CHANGES AND APPOINTMENTS.

S. C. Todd, Inspector under the Diseases in Plants Act at Wallangarra, has been appointed an Inspector of Stock, as from the 7th March, 1924.

S. L. Brimblecombe has been appointed an Honorary Inspector under "*The Diseases in Plants Act of* 1916."

W. T. Harris, H. Nuss, and C. E. Smith, all of Toowoomba, have been appointed Honorary Inspectors under and for the purposes of "*The Diseases in Plants Act of* 1916."

J. R. D. Munro, Warwick; A. B. Smyrell, Roma; and H. J. D. McBean, Ravensbourne, have been appointed Inspectors of Poultry under "*The Diseases in Poultry Act of* 1923."

Jack Davies, Roma, has been appointed an Honorary Inspector of Stock.

The resignation of H. M. Stevens of his position as Chairman of the Egg Pool Board has been approved, and H. H. Bentley has been appointed in his stead.

The appointment of E. J. Shelton, as Instructor in Pig Raising, has been confirmed as from the 17th August, 1923.

WEEDS OF QUEENSLAND.

By C. T. WHITE, Government Botanist.

No. 35.

BITTER BARK, NATIVE CINCHONA OR QUININE (*Alstonia constricta*).

Description.—A small tree, often flowering and fruiting as a shrub, suckering freely from the roots. Bark very bitter, thick and corky on the larger trees. Leaves opposite, lanceolate, 3 to 5 in. long on slender stalks of ½ to 1 in. Flowers small yellow or yellowish green, arranged in terminal cymes. Seed vessels (follicles) in pairs, narrow, round, elongate, 5 in. to about 1 ft. long, splitting open along one side when ripe; seeds numerous, about ½ in. long, covered with long brownish hairs.

Distribution.—A native of Queensland and New South Wales; in Queensland it is very abundant in the drier scrub areas such as occur in the Burnett District, Northern Darling Downs, &c.

Common Name.—The names Bitter Bark, Native Cinchona, and Native Quinine are all in general use. They are also applied to a totally different plant—*Petalostigma quadriloculare*, a small tree with rounded leaves and round yellow fruits.

Botanical Name.—*Alstonia*, in honour of Dr. Charles Alston, Professor of Medicine and Botany in the University of Edinburgh, 1740-1761. *Constricta* (Latin) meaning constricted; the top of the corolla tube of the flower is somewhat constricted.

Troublesome Character.—Many complaints have reached me regarding the growth of this plant in cultivation areas owing to the habit the roots possess of throwing up strong sucker shoots, particularly when disturbed as is done by ploughing.

Economic Uses.—The bark is a valuable tonic, and both it and the bark of *A. scholaris* (a North Queensland and Asiatic species) are official in the British Pharmacopæa. A decoction of the bark has been used as a tick-wash. It has also been used by brewers to add a bitter flavour to beer.

Eradication.—Eradication is probably best carried out by poisoning the plants with an arsenical solution. Standing trees may be "frilled" by making a succession of downward axe cuts right round the tree into the sapwood, each cut overlapping the other so as to leave no unsevered bark or sapwood for the conveyance of food-containing sap for the tree. The solution should now be freely poured into the frill with a watering-can (without a rose) or old teapot or kettle.

Bitter bark suckers freely, and the eradication of sucker growths in paddocks or cultivation areas is more difficult; the suckers might be cut down, however, and a solution painted over the cut stump with a brush or swab. They, also, of course, can be grubbed out, and constant grubbing will exhaust the old roots eventually; an arsenical solution poured round the grubbed plant would no doubt be effective but would poison the ground for some time for all other plants.

A suitable solution is—Arsenic 1 lb., caustic soda 2 lb. or washing soda 3 lb., water 4 gallons. The soda is necessary to help the arsenic dissolve, and Mr. G. B. Burrowes, Assistant Inspector of Agriculture in New South Wales, writing in the "Agricultural Gazette" of New South Wales, recommends the addition of whiting, because the whiting dries white and shows which trees or plants have already been treated. If ordinary washing soda is used, boiling will be found necessary to bring about complete solubility; but, if caustic soda, the heat generated does away with the necessity of boiling.

Botany.—There are two distinct forms of this species in Queensland, the first with the leaves glabrous and smooth on both surfaces, the latter with the young shoots and the under surface of the leaves densely clothed with soft hairs (var. *mollis*), a third variety (var. *montmariensis*) has been described from the Maranoa district, but this is probably only a small leaved form of var. *mollis*.

Reference.—*Alstonia constricta*, F. Mueller, "Fragmenta Phytographiæ Australiæ," 1, 50 (1858).

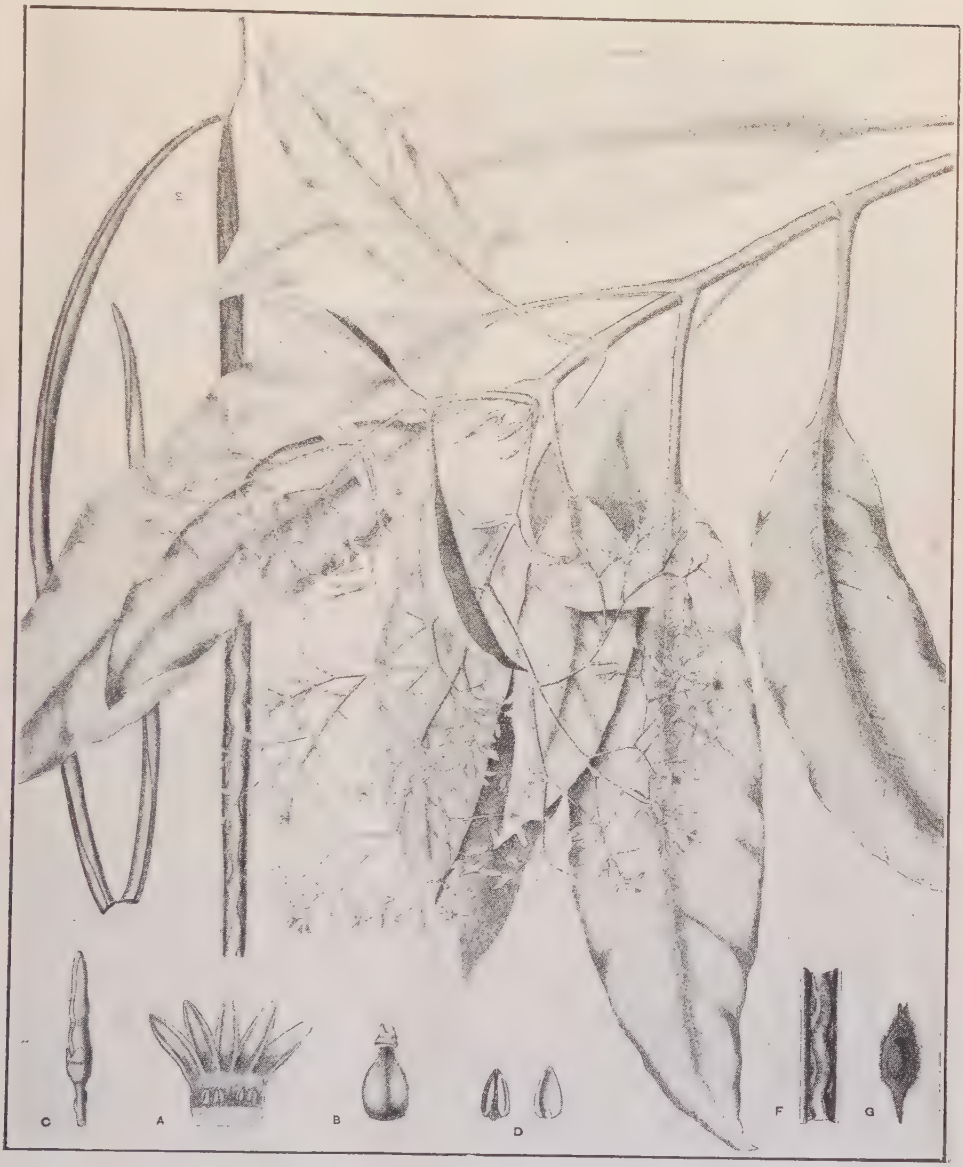

Plate 49.—Bitter Bark, or Native Cinchona (*Alstonia constricta*).

A.—Corollo laid open. B.—Ovary. C.—Flower fluid. D.—Anthers.
E.—Seed pod (follicle). F.—Portion of seed pod enlarged. G.—A seed.

(After Maiden, in "Forest Flora of New South Wales.")

General Notes.

The Primary Products Pools Acts—Regulations.

License Regulations under "*The Primary Products Pools Acts, 1922 to 1923,*" have been issued in relation to wholesale dealers in cheese, and are to take effect as from the date of publication in the "Government Gazette," viz., 8th March. These Regulations provide that every wholesale dealer who desires to trade in cheese shall, before commencing to trade in such commodity, make application to the board for a license to so trade, while every wholesale dealer who is trading in cheese at the date of these Regulations taking effect must make application for a license within thirty days after such date. The board, with the approval of the Minister for Agriculture and Stock, is given the power to grant, or refuse to grant, a license to any applicant, or, having granted, may suspend or cancel any license. Such refusal may be made without any reason being assigned therefor. Every license will be in force from the date it is granted until the 30th June following, unless it is cancelled or suspended, and will not be transferable. The license will be issued free, no charge being made. Any person who commits a breach of these Regulations is liable to a penalty not exceeding £100.

"Bunchy Top" in Bananas—Its Queensland History.

The Acting Premier and Minister for Agriculture (Hon. W. N. Gillies) stated in the course of a recent Press interview that the actual time of the discovery of "Bunchy Top" in New South Wales is not actually known in Queensland, but from general knowledge the first appearance in that State may be set down as from 1910 to 1912. Its occurrence in Queensland was first noted in 1916 by Mr. Benson, the Director of Fruit Culture, who observed it among some banana plants that had been brought from over the border in the previous year. The disease was not, however, treated seriously until 1919, when investigations were made upon a farm at Currumbin. In 1920, as a result of these investigations, an experimental plot, covering two acres, was established at that place, but within twelve months the whole of the plants within the area had become affected. The Government Entomologist also visited the infected area in this State, but no result has been secured from his inquiries. Similar negative results have been experienced by the growers of New South Wales who co-operatively offered a reward of £5,000 for diagnosis and remedy, apart from the investigations being made by Dr. Darnell-Smith, of the Department of Agriculture in New South Wales. Early in June of last year Mr. Green, M.H.R., proposed in the House of Representatives that the Commonwealth should offer a reward for a discovery of a cure, but the Federal Government, after consideration, preferred another course, to which reference is made later. Mr. Gillies at that time expressed the opinion that there would be far greater likelihood of attaining definite results from scientific effort in which competently trained and experienced investigators, prompted, as scientific men are, by other than material considerations, would be engaged. An arrangement was then made with the New South Wales Government whereby Dr. Darnell-Smith, the Plant Pathologist of that State, and Mr. Henry Tryon, Queensland Government Entomologist, would be associated in investigation with the help of other scientific men, like, for instance, Mr. Brünnich, the Agricultural Chemist, who has made exhaustive analyses of soils from areas carrying infected plants. Before, however, any definite action was taken in the matter, the two scientists met to discuss plans for investigation, and after visiting the Tweed area in company they decided to consider the infected area as one whole. Meanwhile, the consideration given by the Federal Government to the proposal made by Mr. Green, M.H.R., had produced another proposal from the Director of the Bureau of Science and Industry, that the Commonwealth, New South Wales, and Queensland should each contribute £1,500 for a further investigation. This was agreed to, and a committee has now been appointed. The members of the committee are Professor Goddard, B.A., D.Sc., Professor of Biology of the Queensland University, Professor Watt, M.A., B.Sc., Professor of Agriculture in the University of Sydney, and Professor Osborn, of the University of Adelaide. This committee has already entered upon its investigations.

Mr. Gillies added further that "Bunchy Top" has caused banana-growers in Queensland and himself considerable alarm owing to the insidious way in which it has advanced, and that it is now imperative that the investigations should be pressed to a degree that some check, if not a remedy, may be found for a plant disease that has hitherto baffled scientific men.

State Cheese Board.

In pursuance of the provisions of "*The Primary Products Pools Acts*, 1922 *to* 1923," and upon the recommendation of the Council of Agriculture, Wm. Purcell, H. H. Collins, and M. Lynch have been appointed Chairmen of the State Cheese Board, Atherton Tableland Maize Board, and Atherton Tableland Pig Board, respectively.

Leichhardt South Dingo Board.

The following amendments have been made to the by-laws of the Leichhardt South Dingo Board published in the *Government Gazette* of the 8th July, 1922:—

Section 2 of By-law No. 2: The word "seven" has been inserted in lieu of the word "twenty-one."

Section 3 of By-law No. 2: The word "four" has been inserted in lieu of the word "three."

The Government Clydesdale Sires.

The Minister for Agriculture and Stock (Hon. W. N. Gillies) has announced that the stallions purchased last year by the Government for the purpose of improving the breed of draught horses in Queensland have completed the season, and are now at the Queensland Agricultural College farm, where, by an arrangement with the Department of Public Instruction, they will remain until the spring. It will be remembered that these horses were bought about July last, and there was not much time for them to become accustomed to Queensland conditions before the season started. The number of mares allotted was consequently limited. The prolonged dry spell that followed was, of course, a factor against the securing of the best results, as stock generally was lower in condition than would be the case during a normal season. Notwithstanding these handicaps the season was fairly successful. In the course of the season 335 mares, an average of 56 each horse, were mated without mishap.

Co-operative Associations Act—Additional Regulations.

Additional regulations under the Primary Producers' Co-operative Associations Act have been issued, and are now in force. They provide, in accordance with the Act, for the registration of associations or federation. Forms of application will, in due course, be sent by the registrar of Primary Producers' Co-operative Associations to the various associations who have already applied for registration under the Act, and to others who in the future apply for registration. The regulations also deal with the registration of secretaries, treasurers, and directors of associations; the registration of amendments of rules of associations from time to time; the licensing of auditors; the cancellation of registration of associations or licenses of auditors when deemed necessary for the exemption, withdrawal, or dissolution of associations; exempting associations or companies from the operations of the Act by the Governor in Council on the recommendation of the Council of Agriculture, and the scale of fees.

Each of the following co-operative trading societies registered under the Industrial and Provident Societies Act, with the word "co-operative" as part of its registered name shall, until further notice, be allowed to continue to use the word "co-operative" as part of its name as so registered:—West Moreton Co-operative Society, Limited; Caboolture and District Co-operative Cash Stores, Limited; Maroochy Co-operative Society, Limited; Burnett Farmers' Co-operative Trading Society, Limited; Kenilworth Farmers' Co-operative Society, Limited; Fassifern Farmers' Co-operative Cash Trading Society, Limited; Toogoolawah District Co-operative Society, Limited; Twin View Co-operative Society, Limited; and Mapleton Co-operative Trading Society, Limited.

Every association shall keep a register of mortgages and a register of shareholders or members. A copy of the rules or articles of association of any association shall be supplied to any member upon application by him at a charge, including postage, not exceeding 2s. 6d.

A general meeting of the association shall be held within at least six months from the first registration of the association. Subsequent general meetings shall be held at least once within every twelve months.

Every association and every officer or member thereof committing a breach of any of these regulations shall, for every such breach, be liable to a penalty (where same is not provided for in the Act) not exceeding £20. The full text of the Regulations, schedules, and forms have been gazetted.

The War Against the Fruit Fly.

Regulation 57 under "*The Diseases in Plants Act of* 1916" has been rescinded, and Regulation 59 has been issued in lieu thereof. This Regulation provides that for the period commencing 1st April, 1924, and ending 31st March, 1925, the introduction of certain fruits into the Stanthorpe district, from any district within which the common Queensland fruit fly, or the Mediterranean fruit fly, or the spotted fruit fly, are known to exist is prohibited, unless such fruit has been in cold storage for a period of not less than twenty-one days at a temperature of not more than 35 degrees Fahr.

Sugar Research Scholarships.

Travelling Research Scholarships in connection with the sugar industry have been awarded as under:—

Arthur Frank Bell, Assistant to Analyst, Agricultural Chemical Laboratory, Department of Agriculture and Stock, to be Plant Pathology Scholar.

Henry William Kerr, Assistant to Analyst, Agricultural Chemical Laboratory, Department of Agriculture and Stock, to be Soils Scholar.

Norman Bennett, Assistant Sugar Chemist, South Johnstone Central Sugar Mill, to be Technology Scholar.

The scholarships will be tenable for a period of four years, and in the course of that period the holders will travel in various parts of the world for the purpose of studying every phase of the industry.

Khaki Weed and Blue Top.

The Government Botanist, Mr. C. T. White, F.L.S., replying to a request for information, writes:—

Many persons are much alarmed at the spread of these two pests on the Downs and some other parts of Queensland.

The khaki weed (*Alternanthera achyrantha*) is a native of South America, and was introduced into South Africa in the fodder from the Argentine during the time of the Boer war, and from South Africa it is thought to have made its way into Australia. Since its introduction to Australia it has steadily increased until it has become one of our worst weed pests. In 1918, an officer of the Department of Agriculture and Stock, Mr. F. B. Smith, B.Sc., Assistant Agricultural Chemist, visited Beaudesert to inquire into the destruction of khaki weed by chemical means, and reported that, "The weed was easily destroyed by common salt (butchers' salt or any coarse common waste salt) at the rate of 1-2 tons per acre. A weak arsenical solution containing 2 per cent. arsenic will also be found effective where this poisonous spray could be used."

The value of salt as a weed destroyer lies in its property of absorbing moisture both from the soil and plant tissues, and so kills the plant by thirst. Thus, to prove effective, it should be applied in hot, dry weather.

In small areas khaki weed is best destroyed by hand-grubbing or chipping, but as it has the power of sending out roots from the joints there is always a chance, unless the work is carried out in hot, dry weather, of the cut pieces growing again, so that the cut up plants should be all raked up and burnt.

Blue Top has been identified as *Heliotropium anchusæfolium*, a South American species of heliotrope that has been naturalised in Queensland for some years past. The species was no doubt introduced as a garden plant, and has been naturalised on the coastal lands for many years past, but has never given evidence there of being of an aggressive nature. A few years ago it made its appearance about Warwick, and has established itself as a very bad weed, most difficult to eradicate. The plant is a perennial, and makes a long, strong, slender tap root. In small areas such as gardens and household allotments, forking or pulling out the plant so that the central root is destroyed is the best means of eradication. In larger areas the plants should be hoed off, care being taken to see that the central root is cut off well below the surface of the ground.

Where it can be used in safety an arsenical spray might be tried, and as a spray suitable for weed destruction the Agricultural Chemist (Mr. J. C. Brünnich) has recommended the following:—"Half a pound of arsenic dissolved by means of one-quarter of a pound of caustic soda in 3 gallons of water, and the solution then diluted to 10 gallons with water." As the plant is of comparatively recent introduction on the Downs, and it already shows the power of becoming a bad pest, a lookout should be kept for it and the plants destroyed where they put in an appearance. It can be easily recognised by its blue flowers and typical heliotropey appearance.

Weights of Pigs at Weaning Time.

Several inquiries have recently been made on this subject, and it is an important one worth careful investigation. It is, however, difficult to quote figures regarding estimated weights of pigs at weaning time when the age at which the pigs were weaned is not clearly stated. The common practice in Queensland is to wean the pigs at seven to eight weeks old, but in the case of most of the figures that have been published on this subject, the weaning age is stated as from nine to ten weeks or even more. Then, again, there is little or no information available here covering results of experiment work or in keeping records such as these. My experience is that if pigs in any breed can be forced along so that they will weigh round about 35 lb. at weaning time (*i.e.*, eight weeks) then the breeder cannot complain. There are instances on record here in which pigs have weighed up to 45 lb. at this age.

Henry and Morrison, in their new "Feeds and Feeding" (an American publication), record various experiments that have been carried out on these lines, and a general average of the weights at weaning time (in this case at eight to ten weeks of age) runs about 38 lb., the weights varying from about 22 lb. in the case of the younger and lighter pigs, to 57 lb. in the case of the very best of the pigs.

In Australia we do not appear to be able to secure the very heavy weights in pigs recorded abroad, and in the case of the Large Black Pig Records in England the weights appear to be excessive. Yet under Australian conditions the Large Black made no headway, and after a few years' popularity they failed to "fill the bill" and have now gone out of favour altogether.

It would appear that if pigs are properly managed and given the right class of food, they should, after reaching the age of about eight weeks, begin to increase in weight at the rate of 1 lb. per day, so that at the age of six months (or roughly 120 days after weaning) they should weigh 120 lb., plus the weight at weaning time, which would ordinarily be about 35 lb., or a total weight at six months' old of around 155 lb. live weight.—E. J. SHELTON, H.D.A., Instructor in Pig Raising.

Forthcoming Shows.

The Queensland Chamber of Agricultural Societies has supplied the following list of show dates for 1924:—

Killarney: 19th and 20th March.
Toowoomba: 25th to 27th March.
Royal National Fat Steer Show: 29th March.
Dalby: 2nd and 3rd April.
Chinchilla: 8th and 9th April.
Nanango: 3rd and 4th April.
South Brisbane: 5th April.
Allora: 9th and 10th April.
Wallumbilla: 15th and 16th April.
Clifton: 16th and 17th April.
Herberton, 21st and 22nd April.
Oakey: 24th April.
Maleny: 23rd and 24th April.
Goondiwindi: 29th and 30th April.
Taroom: 6th and 7th May.
Blackall: 6th and 7th May.
Toogoolawah: 7th and 8th May.
Wondai: 8th and 9th May.
Boonah: 14th and 15th May.
Springsure: 14th and 15th May.
Murgon: 15th and 16th May.
Kilkivan: 21st and 22nd May.
Ipswich: 21st to 23rd May.
Emerald: 21st and 22nd May.
Beaudesert: 28th and 29th May.
Marburg: 2nd and 3rd June.
Esk: 4th and 5th June.
Maryborough: 3rd to 6th June.
Childers: 10th and 11th June.
Bundaberg: 12th to 14th June.
Pine Rivers: 13th and 14th June.
Lowood: 20th and 21st June.
Rockhampton: 24th, 26th, 27th, and 28th June.
Mackay: 3rd to 5th July.
Kilcoy: 3rd and 4th July.
Biggenden: 3rd and 4th July.
Bowen: 9th and 10th July.
Caboolture: 17th and 18th July.
Sunnybank: 19th July.
Barcaldine: 22nd and 23rd July.
Rosewood: 23rd and 24th July.
Ithaca: 25th and 26th July.
Nambour: 30th and 31st July.
Mount Gravatt: 2nd August.
Humpybong: 7th August.
Royal National: 11th to 16th August.
Gympie: 20th and 21st August.
Belmont: 23rd August.
Imbil: 27th and 28th August.
Crow's Nest: 4th September.
Wynnum: 6th September.
Beenleigh: 11th and 12th September.
Zillmere: 13th September.
Stephens: 20th September.
Rocklea: 27th September.
Southport: 10th October.

Farm and Garden Notes for April.

FIELD.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April:—Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

In those areas where seasonable rainfall permitted the planting of potatoes, these should now be showing good growth and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of "burgundy mixture," a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and, where necessary, thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—*i.e.*, those which require a fairly long period to develop in, every effort should be made to bring the seedbed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

KITCHEN GARDEN.—Hoe continually among the crops to keep them clean, and have beds well dug and manured, as recommended last month, for transplanting the various vegetables now coming on. Thin out all crops which are overcrowded. Divide and plant out pot-herbs, giving a little water if required till established. Sow broad beans, peas, onions, radish, mustard and cress, and all vegetable seeds generally, except cucumbers, marrows, and pumpkins. In connection with these crops, growers are recommended to adopt some form of seed selection for the purpose of improving the quality of vegetables grown by them. Just at present, selections should be made from all members of the cucurbitaceæ (pumpkins, cucumbers, &c.). Tomatoes should also be selected for seed. Early celery should be earthed up in dry weather, taking care that no soil gets between the leaves. Transplant cauliflowers and cabbages, and keep on hand a supply of tobacco waste, preferably in the form of powder. A ring of this round the plants will effectually keep off slugs.

Orchard Notes for April.

THE COASTAL DISTRICTS.

In the orchard notes for March the attention of citrus growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known in the trade as specking—viz., a rotting of the fruit caused by a mould fungus, and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that specking cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing specking can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy for specking is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury, as the cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and specking follows in due course.

The remedy for specking is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus becomes toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of specking or injury from fruitflies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For Southern markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to send to the Southern States, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, as from now till the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, in the first place, to retain moisture in the soil, and, in the second, to enable birds, ants, and predaceous insects to get at and destroy the pupæ of fruitflies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly cleared land time to sweeten before planting.

Strawberries can still be planted, and the earlier plantings must be kept well worked and free from all weeds in order to get a good crop of early fruit.

Scrub land intended for bananas can be felled now, as there will be little more growth, and it will have ample time to dry off properly in time for an early spring burn. Do not rush scrub falling, as it is work that pays for extra care. Lopping will improve prospects of successful fire.

Keep a keen lookout for fruit flies, and on no account allow any fallen fruit of any kind to lie about on the ground unless you are looking for trouble with the ripening citrus crop. Keep the fly in check, and there will not be any very serious losses; neglect it, and there will not be much fruit to market.

The advice given with respect to the handling and marketing of citrus fruit applies equally to custard apples, pineapples, bananas, and other fruits. In the case of bananas handled by the Committee of Direction of Fruit Marketing, grading is now compulsory, and it will undoubtedly tend to stabilise the market for this fruit.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Practically the whole of the fruit crop will have been gathered by the end of March, but several of the later-ripening varieties of apples grown in the Granite Belt may be kept for a considerable time, provided they are free from fly or other pests and are stored under proper conditions. Varieties such as Jonathan can be kept for some months at a temperature of 31 to 32 deg., and later varieties, such as Granny Smith and Sturmer can be kept till apples come again if stored at the same temperature. At the same time, although storing the fruit at this temperature under artificial conditions enables them to be kept for many months, the fruit can be kept for a considerable period, and marketed from time to time as desired, by storing it in a specially constructed apple-house in or adjacent to the orchard where grown.

Such a store can be cheaply constructed in the side of a hill out of the soil of the district and slabs of timber. The soil will make excellent pisé for walls, and the roof may be constructed of slabs covered with soil. Such a store can be kept at a very even temperature, and if the air is changed during cool nights—not frosty nights—the temperature can be reduced to a low point—low enough to keep the fruit in good condition for many weeks.

All orchards and vineyards not already cleaned up must be put in order, and all weeds destroyed. Keep the surface of the soil stirred so as to give birds and insects a chance to get at any fruitfly pupæ, as it is necessary to destroy this pest whenever there is a chance of doing so.

Land intended for planting during the coming season should be got ready in order to expose the soil to the cold of winter, thus rendering it sweeter and more friable.

If there is any slack time in the course of the month, go over all surface and cut-off drains and put them in good order. Also, if during periods of heavy rain, soft or boggy spots have made their appearance in the orchard, do what draining is necessary, as badly drained land is not profitable orchard land, and the sooner it is drained the better for the trees growing upon it. Soft or boggy spots are frequently caused by seepage of water from a higher level. In this case a cut-off drain will be all that is necessary, but where the bad drainage is due to hard pan or an impervious subsoil, then underground drains must be put in. After draining, the land should be limed. Liming can be done now and during the following three months, as autumn and winter are the best times to apply this material.

When the orchard soil is deficient in organic matter (humus) and nitrogen, try the effect of green-crop manuring, planting the grey or partridge pea and manuring the ground for this crop with a good dressing of finely ground island phosphate or basic phosphate.

Where citrus fruits are grown, they should now be ready for marketing. If the land needs it, it should be given an irrigation, but unless the trees are suffering from want of water it is better to stick to the use of the cultivator, as too much water injures the keeping and carrying qualities of the fruit.

The remarks on the handling and packing of citrus fruits in the coast districts apply to the inland districts also, but these districts have an advantage over the coast in that, owing to the drier atmosphere, the skin of the fruit is tougher and thinner and in consequence the fruit carries better.